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RESEARCH ARTICLE

Agreement of variables derived from the countermovement jump between the My Jump Lab and JumPo 2 applications

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Abstract

Background: The countermovement jump (CMJ) is widely used to assess neuromuscular performance in various contexts. For evaluation purposes, apps such as My Jump Lab and JumPo 2 emerge as accessible alternatives to force platforms, offering practicality and low cost. However, to date, no study has directly investigated the agreement between these two apps in measuring CMJ variables. **Objective:** To verify the agreement of CMJ-derived variables between the My Jump Lab and JumPo 2 apps. **Methods:** Fifty young adult women performed three maximal CMJ while being simultaneously filmed with a smartphone camera. Each jump was analyzed using the My Jump Lab and JumPo 2 apps, considering the following parameters jump height (cm), flight time (ms), force (N), and power (W). To compare the applications, the t-test, Pearson correlation, intraclass correlation coefficient (ICC), Bland-Altman plots and effect sizes (Cohen's d) were used, with a significance level of $p < 0.05$. **Results:** The difference between the applications was low ($p > 0.05$), with insignificant effect sizes ($d < 0.20$), in addition to presenting a high correlation for all observed parameters (jump height: $\Delta = 0.19 \pm 1.04$ cm, d = 0.17, ICC = 0.985, r = 0.973; flight time: $\Delta = 0.52 \pm 12.97$ ms, d = 0.04, ICC = 0.983, r = 0.967; force: $\Delta = 23.16 \pm 150.72$ N, d = 0.15, ICC = 0.825, r = 0.705; power: $\Delta = 21.55 \pm 133.93$ W, d = 0.16, ICC = 0.918, r = 0.850. **Conclusion:** The smartphone applications My Jump Lab and JumPo 2 have high agreement for analyzing measures derived from the CMJ, especially for jump height and flight time.

Keywords: Mobile applications; physical fitness; athletic performance.

BACKGROUND

The countermovement jump (CMJ) is widely used to assess and monitor neuromuscular performance in different contexts and populations, both in sports as a method for assessment, recovery, and return to sport[1-3], and in other contexts as a marker of eccentric strength and power, which are important indicators for discharge after injury in various populations. It can also be used during treatment as a physical rehabilitation method[4-7]. Given its popularity for assessing lower limb strength, power, and overall functionality, the CMJ is considered a versatile, practical, and non-invasive test. Traditionally, its analysis is performed using force platforms, considered the gold standard for measuring variables such as jump height, strength, and power. However, the high cost and low portability of this equipment limit its application in clinical and field settings[2, 8, 9].

Faced with these limitations, more accessible alternatives have emerged, such as smartphone apps. Besides being low-cost, these resources offer practicality and ease of use, making them attractive to healthcare professionals, trainers, and researchers working outside of laboratory settings. Among the available apps, My Jump is the most

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studied, validated, and considered reliable in scientific literature for analyzing jump height and flight time. This app was recently renamed My Jump Lab. However, JumPo 2, another app capable of evaluating the same variables measured by My Jump Lab, has also demonstrated validity and reliability for measuring variables derived from the CMJ[10-12]. These apps use slow-motion videos and specific algorithms to estimate jump variables based on images captured by the device itself. Although both are considered valid for measuring the CMJ, especially regarding jump height, JumPo 2 remains little explored in scientific literature. Another relevant issue concerns cost. Although My Jump Lab is relatively low cost and easy to access, Jumpo 2 is completely free, a factor that can directly influence the user's choice[10].

In this context, although interest in digital tools for assessing vertical jump has grown in recent years, there are still no studies directly investigating the agreement between the My Jump Lab and Jumpo 2 apps. Considering that both use similar methodologies and aim to measure the same variables, it is necessary to understand whether they provide interchangeable results. This analysis may be relevant for professionals seeking accessible and reliable solutions, especially in scenarios where the cost or availability of technological resources may influence the choice of method. Thus, understanding the level of agreement between these apps can contribute to more efficient decisions regarding the use of these tools in clinical, sports, and scientific practice. Therefore, the objective of this study was to verify the agreement of variables derived from the CMJ between the My Jump Lab and Jumpo 2 apps.

METHODS

This was a non-experimental, exploratory, methodological study[13]. Participants were recruited from the community, primarily through advertisements on social media, messaging apps, and invitations made in public places in the city of Jacarezinho (PR), Brazil. Inclusion criteria were a) female, aged between 18 and 35 years; b) not having exercised in the last 6 months; c) being fit to practice exercise according to the Physical Activity Readiness Questionnaire (PAR-Q) criteria; d) having no musculoskeletal or neurological disorders that could affect performance during the tests; e) having no known cardiovascular or respiratory diseases; f) having no cognitive impairment that would lead to the inability to follow simple commands; g) being a non-smoker; h) not being pregnant.

The final sample consisted of 50 participants with a mean age of 24.7 ± 5.2 years, body mass of 67.1 ± 11.4 kg, height of 163.6 ± 5.6 cm and body mass index of 25.1 ± 4.4 kg/m^2. All participants signed an informed consent form. The study was previously approved by the Human Research Ethics Committee of the Universidade Estadual do Norte do Paraná (CAAE 89410418.4.0000.8123).

Vertical jump assessment

The CMJ was preceded by a standardized warm-up that included dynamic stretching exercises (hip flexion and extension, hip internal and external rotation, and trunk rotation, with 10 repetitions of each movement) and five submaximal CMJs, which, in addition to warming up, were intended to familiarize the participants with the movement. Next, three maximal CMJs were performed, separated by a one-minute rest between attempts. The hands were placed on the waist throughout the test, and the participants wore their standard shoes (tennis shoes).

To analyze the CMJ parameters (jump height [cm], flight time [ms], force [N], and power [W]), the My Jump Lab (v. 1.3.4) and JumPo 2 (2.3.4) apps were used, both installed on a Samsung Galaxy A31 smartphone with Android 12 operating system and a 30-fps camera. The phone was positioned 1.0 m in front of the participant and 75 cm high on a tripod. Both apps calculate flight time by detecting video frames. An evaluator randomly identified the last frame in which at least one foot was on the ground (takeoff) and, subsequently, the first frame in which at least one foot touched the ground (landing) for both apps.

Based on the flight time, the applications estimate the jump height by applying the constant acceleration equation (flight time 2 × 1.22625)[14]. Finally, based on the jump height, body mass (kg), gravitational acceleration (g) and measurements of the length of the extended lower limb (cm) and at 90º of knee flexion (cm), the applications estimate the average values of force and power generated during the propulsive phase of the CMJ[15].

Statistical analysis

The mean values of the three CMJ were calculated for each variable. Data was presented as mean and standard deviation. Data normality was verified using the Shapiro-Wilk test. The one-sample t-test was used to calculate the mean and standard deviation of the difference between applications for each parameter. The correlation between applications was analyzed using Pearson's correlation coefficient (r) and complemented by the Intraclass Correlation Coefficient (ICC). Bland-Altman plots were created to graphically visualize the agreement between applications[16]. The strength of the correlations was considered weak (<0.40), moderate (0.40–0.69), and strong (≥0.70)[17]. The effect sizes for each parameter between applications were calculated using Cohen's d, which was considered insignificant (<0.20), small (0.20–0.49), medium (0.50–0.79), or large (>0.80)[18]. For all tests, the significance level adopted was 95% ($p < 0.05$). The analyses were processed in the SPSS 25.0 program (Chicago, IL, USA), except for the effect size calculations (Cohen's d), which were processed in the GPower 3.1 program (Franz Faul, Universita¨t Kiel, Germany).

RESULTS

Table 1 presents the values for all parameters considered between the My Jump Lab and JumPo 2 applications. The values measured between the applications were not statistically different for any of the variables considered, in addition to presenting a negligible effect size. Furthermore, the intraclass correlation coefficients were all above 0.90, except for the force variable, where the value was 0.825, with the lower limit of the confidence interval below 0.70.

Table 1. Agreement between the My Jump Lab and Jumpo 2 applications for different variables derived from the countermovement jump

Variables	Mean (standard deviation)			p	d	ICC (95%CI)	p
	My Jump Lab	Jumpo 2	Difference				
Jump height (cm)	15.63 (4.44)	15.44 (4.16)	0.19 (1.04)	0.206	0.17	0.985 (0.973 – 0.991)	0.00
Flight time (ms)	351.76 (50.75)	351.24 (47.82)	0.52 (12.97)	0.778	0.04	0.983 (0.970 – 0.990)	0.00
Average force (N)	1048.36 (186.21)	1025.20 (204.06)	23.16 (150.72)	0.283	0.15	0.825 (0.692 – 0.900)	0.00
Average power (W)	918.77 (238.93)	897.22 (248.25)	21.55 (133.93)	0.261	0.16	0.918 (0.856 – 0.953)	0.00

Note: ICC: Intraclass Correlation Coefficient; 95%CI: 95% confidence interval.

In Pearson's correlation tests, a strong correlation was observed for all variables ($r \geq 0.70$), with the highest values presented by the variables jump height and flight time ($r \geq 0.96$) (Figure 1). Finally, in the Bland-Altman plots, it is possible to observe that there was low bias between all measures derived from the My Jump Lab and Jumpo 2 applications, especially for jump height and flight time, with narrow confidence intervals (Figure 2).

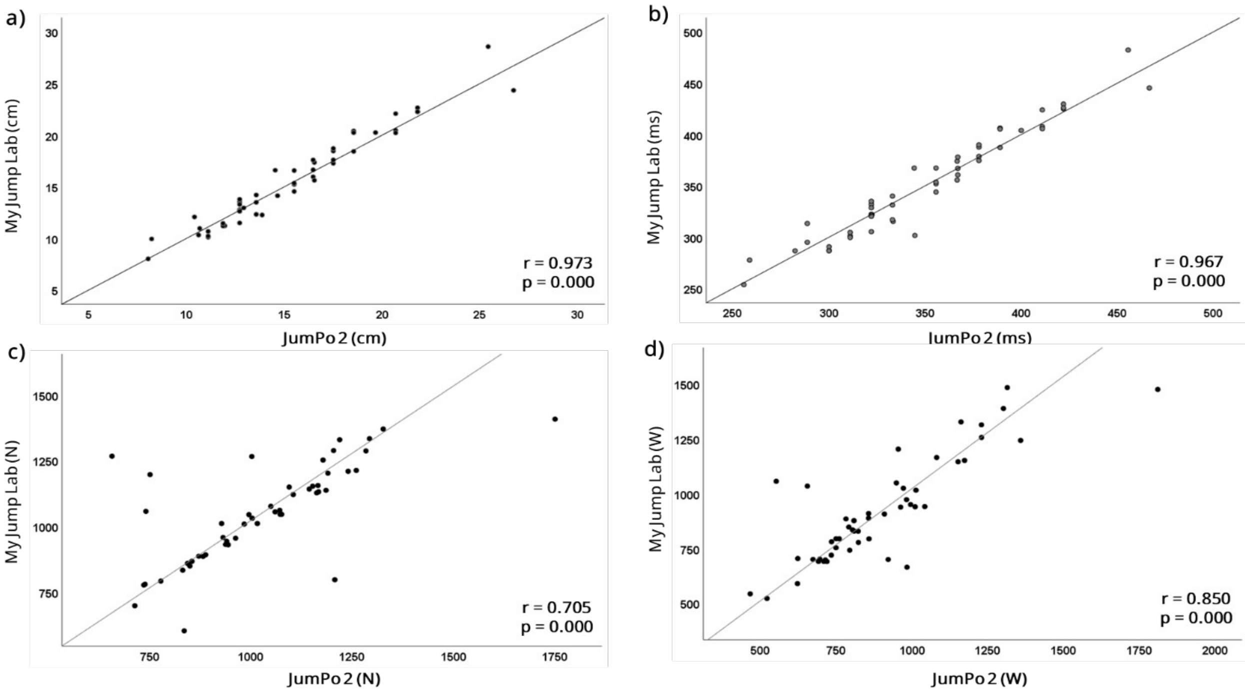

Figure 1. Correlation between the My Jump Lab and Jumpo 2 applications for analyzing parameters derived from the countermovement jump: a) jump height (cm); b) flight time (ms); c) average force (N); d) average power (W)

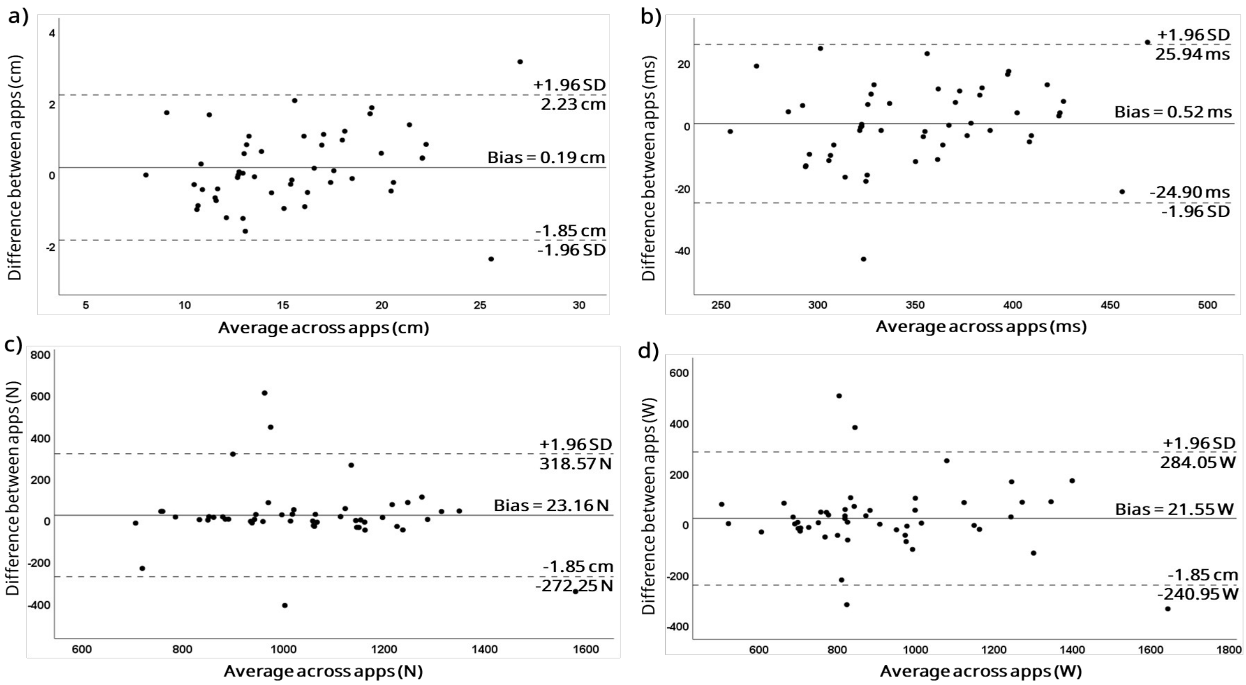

Figure 2. Bland-Altman plots demonstrating the agreement between the My Jump Lab and Jumpo 2 applications for parameters derived from the countermovement jump: a) jump height (cm); b) flight time (ms); c) average force (N); d) average power (W)

DISCUSSION

The present study aimed to verify the agreement between the My Jump Lab and Jumpo 2 apps for measuring variables derived from the CMJ. The main findings indicated high agreement between the two apps for most of the variables analyzed, particularly jump height and flight time, which presented intraclass correlation coefficients above 0.98 and insignificant effect sizes. Pearson's correlation results were nearly perfect (r = 0.973 and r = 0.967). Furthermore, Bland-Altman plots demonstrated low bias and narrow confidence intervals for these variables, reinforcing the similarity between the data obtained by the two apps. Although force and power values also showed strong correlation, the intraclass correlation coefficient was slightly lower for these variables, especially for average force.

The findings of the present study corroborate the literature that demonstrated the validity and reliability of the My Jump Lab and Jumpo 2 applications separately compared to the force platform, considered the gold standard for analyzing the vertical jump[11]. Regarding My Jump Lab, excellent accuracy has already been demonstrated for measuring jump height and flight time, with high reproducibility among different evaluators[10,19,20]. Although JumPo 2 has been less explored, recent research has demonstrated that it also presents validity comparable to My Jump Lab, with a strong correlation with force platform data[10, 21].

Regarding the jump height variable, excellent agreement was observed between the two applications, which is consistent with the findings of previous studies that demonstrated a strong correlation for this measurement[12, 22]. Flight time, often used as a basis for calculating height, also showed high similarity, which reinforces the reliability of the algorithms of both applications for detecting takeoff and landing frames[21,23].

However, small variations in the marking of takeoff and landing frames can interfere with the calculations of secondary estimates such as force and power, which may justify the lower agreement observed in these variables compared to temporal and spatial measurements[10, 24].

From a practical perspective, the results of this study may be relevant for professionals working in clinical, educational, or sports training settings, where the availability of sophisticated equipment, such as force platforms, is limited[20,25]. Considering that My Jump Lab is affordable but still requires a fee, JumPo 2 presents itself as a free and viable alternative for CMJ analysis. The ability to safely use either application for measurements such as jump height and flight time allows for greater methodological flexibility and may contribute to expanding access to reliable neuromuscular performance assessment[10, 21].

Despite the important results observed, this study has some limitations that need to be highlighted, such as the sample composed solely of young adult women, which limits generalizability to other age groups, genders, or clinical populations. Furthermore, the video analysis was performed by a single rater, which prevents verification of inter-rater reliability, given that manually marking the frames may indicate potential bias[22].

Another factor that may indicate bias is the camera's refresh rate (30 fps) available on the smartphone used, which may make it difficult to accurately record takeoff and landing due to fewer frames available for analysis compared to smartphones that can reach up to 240 fps, thus increasing accuracy.

Based on these findings, future studies are needed to explore the reliability of the My Jump Lab and JumPo 2 apps in different contexts, such as with older populations, elite athletes, or during training and rehabilitation protocols. More comprehensive research is also needed comparing the JumPo 2 to gold-standard devices for CMJ assessment. It would also be relevant to investigate the impact of different evaluators on scoring consistency and analyze the apps' performance on devices with different camera qualities, frame rates, and operating systems.

CONCLUSION

The findings of this study indicate that the My Jump Lab and Jumpo 2 apps exhibit high agreement in measuring variables derived from the CMJ, particularly jump height and flight time. Considering that My Jump Lab is low-cost and Jumpo 2 is free, the choice between the apps can be guided not only by similar technical accuracy but also by resource availability, context of use, and evaluator preferences. These findings indicate that the use of these tools can be accessible and reliable alternatives in professional and scientific practice.

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