# RELIABILITY OF A FLIGHT TIME MEASUREMENT INSTRUMENT DURING VERTICAL JUMP

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Researchers and practitioners who evaluate performance of study participants, patients, athletes or other clients, should use tests with high reliability, because these are the only tests that can have high validity. The aim of this study was to determine the reliability of a contact mat (CM). For this, sixteen volunteers had carried out a series of three vertical jumps in the test and had repeated the same procedure one week later in the retest. The flight time was registered by CM and force plate (FP) simultaneously. The result of the Mann-Whitney test showed that did not have significant difference between the test and retest in two instruments, and the correlation values were high between test and retest and between the instruments. From these results, it is concluded that the tested CM is a reliable tool to measure the flight time of the vertical jump.

**KEY WORDS:** reliability, contact mat, flight time, vertical jump.

## INTRODUCTION:

Vertical jump tests have largely been used to assess different forms of strength in the extensor muscles of the lower limbs. From the scientific literature three main methods to calculate the vertical jump height can be differentiated (García-Lopez *et al*., 2005): the vertical difference between two body landmarks or points (hands, waist, head or center of mass); estimating jump height once flight time, measured with especific instruments; finally maximum jump height can also be calculated using the appropriate equations for take-off velocity and impulse (between force plates).

According with Hopkins *et al*. (2001), researchers and practitioners who assess performance of study participants, patients, athletes or other clients should use tests with high reliability, because these are the only tests that can have high validity. The use of reliable and valid testing procedures is beneficial for monitoring the effects of training and for talent selection purposes (Markovic *et al*., 2004).

Some researchers have looked for to inquire the validity and the reliability of diverse tools and tests carried out in the field of sport science, as much for the research as for the training (Hatze, 1998; Sayers *et al*., 1999; Hopkins *et al.,* 2001; McLaughlin *et al*., 2001; Rietjens *et al*., 2001; Cronin *et al*., 2004; Markovic *et al*., 2004; García-López *et al*., 2005).

The evidence of the reliability of instruments that measure vertical jump height will to supply greater security to the practitioners and researchers whom they need trustworth tools. Moreover, such evidence will be able to lead consequently of the use of these instruments in sport environment, leading to the improvement of the system of evaluation and formation of athlete. Therefore, the aim of this study is to determine the reliability of a contact mat that measures the vertical jump height through the flight time.

## METHODS:

**Data Collection:** Sixteen (16) individuals not athlete had participated of the study as voluntary (8 women and 8 men), with average age of 26,2 ± 4,1 years, mass 64,8 ± 9,5 kg and height 1,71 ± 0,09 m. All the volunteers had been informed about procedures of the tests and had signed an assent term to participate of the study, after an explanation about the procedures by the testers.

After a familiarization, each volunteer carried out three jumps (Squat Jump) starting of the position of 90° of flexion of knees, keeping the hands in the hips, with interval of one minute

between each jump (test). Was requested to the volunteers who they jumped as highest as possible. One week later, they had returned to the laboratory and had carried out the same procedures (retest).
All the jumps had been carried out in the same Contact Mat (CM) called JumpTest® (50 x 60 cm), connected to Multisprint® software. It consist of two conductive surfaces that turn off the electric circuit with small pressures (switch principle). In the moment that subject foots loose the contact with the mat, a timer is shooted, the time interruption happen in the moment that subject foots contact the mat again. In this way, the flight time is measured.
The flight time of jumps was recorded simultaneously with two different systems. Beyond the CM, a Force Plate (FP) PLA3-1D-7KN/JBA *Zb. Staniak*, Poland® was placed under the CM and connected to MVJ3 software®. It had a sampling frequency of 500 Hz and was zeroed with the CM placed on the FP. The place of realization of the tests was the same and the testers also.
**Data Analysis:** For the statistical treatment and discussion of the results were used the flight time parameter supplied from the systems. The data had been presented using descriptive statistics and expresses on average and standard deviation. The normality of the sample was assessed using a Kolmogorov-Smirnov test. To determine the reliability of the CM was used the test of Spearman correlation and Mann-Whitney test between test and retest values of CM and FP and test of Spearman correlation between the instruments in the test and retest. The adopted significance level was of $p < 0.05$. The analysis of the data was made through software SPSS version 12.0.

**RESULTS:**

The normality test showed that the sample was unusual. A total of 48 jumps in the test and the same in the retest were carried out. In Table 1 we observe the values (Average, Standard Deviation, Standard Error and Significance Level (*p*)) of the test and the retest referring to flight times registered by two instruments.

**Table 1: Average, Standard Deviation, Standard Error and Significance Level (*p*) of flight times measured with CM and FP in the test and in the retest.**

| Instrument | Situation | Average | Standard Deviation | Standard Error | *p* |
|---|---|---|---|---|---|
| CM | Test | 0,458 | 0,055 | 0,008 | 0,706 |
| CM | Retest | 0,460 | 0,055 | 0,008 | |
| FP | Test | 0,486 | 0,055 | 0,008 | 0,722 |
| FP | Retest | 0,487 | 0,053 | 0,008 | |

$p < 0,05$

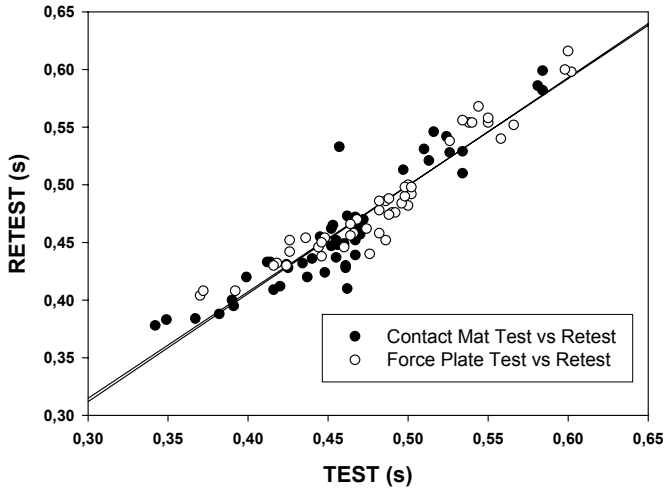


Figure 1: Spearman correlation between test and retest of CM and FP.

No significant differences in flight time measured by CM and FP were found between the values of the test and the retest ($p > 0.05$).
The result of the correlation between test and retest of CM was 0.877 and the FP correlation result between test and retest was 0.956 (Figure 1).
The result of the correlation in the test between CM and FP was 0.959. In retest the result of correlation between CM and FP was 0.988 (Figure 2).

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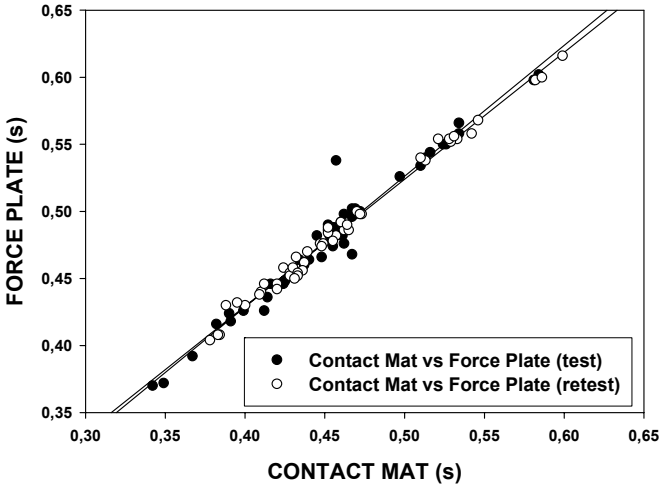


Figure 2: Spearman correlation between CM and FP in the test and retest.

## DISCUSSION

There are many types of reliability, for example, intra-tester, inter-tester and intra-subject reliability. In this study, the type of reliability studied was the reliability of an instrument, or reliability test-retest. It evaluates the capacity of the measure instrument to supply the same measures or consistent results. It is tested making measured repeated using the same instrument (Gadotti et al., 2006). In this study the reliability of the CM Jumptest® was tested with the retest being carried out one week after the test. Gajdosik and Bohannon (1987) afirm that reliability studies conducted over days, or over weeks, are important for assessing the stability of the measurement, and then comparisons can be made to evaluate the athletes improvements.
In its study, Gadotti et al. (2006) suggest that the tests of correlation is frequently used for reliability measurement, and that values greater than 0.75 indicate that it is good. Therefore, the CM Jumptest® tested in the present study presents high reliability ($r = 0.877$). Besides, the correlation values between the CM and the other instrument was very high, as much in test as in retest.
Such result assures them that it is a tool capable to evaluate with security the progression of training, once small changes in the athlete performance must be considered by the trainers. Moreover, in the scientific research also it is necessary to use stable tools, to assure that the gotten results are trustworthy.
Reliability Researchers has been made using the Coefficient of Variation (CV) and the Intraclass Correlation Coefficient (ICC) (Cronin et al., 2004 and Markovic, et al., 2004), however, in accordance with Hopkins et al. (2001), in a review study about reliability of power in physical performance tests, the measure of reliability cited in most publications is the retest correlation coefficient (r), but such measure is sensible to the heterogeneity of the sample (interindividual SD). In the present study, even with the standard deviation of the test and the retest being relatively high (0.066 and 0.061 respectively), the value of the r was high (0.960).

## CONCLUSION

The highs values of the Spearman correlation, the inexistence of significant difference between the test and the retest and the highs values of the Spearman correlation between the CM and the FP in the test and the retest shows that the CM Jumptest® tested is reliable. This will supply greater security to practitioners and researchers who use this tool to measure the flight time of the vertical jump, leading to improvement of the evaluation system and athletes formation. Later, new studies must even though be carried out with a bigger sample and with other statistical treatments.

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