THE LINK BETWEEN PHYSICAL PERFORMANCE AND SELF-EFFICACY: HOW MUCH CAN I JUMP?

IL LEGAME TRA PRESTAZIONE FISICA E AUTOEFFICACIA: QUANTO POSSO SALTARE?

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ABSTRACT

This study evaluated the reliability of self-efficacy in predicting squat jump performance in young adults. Participants completed a questionnaire and performed three jumps while their actual jump height was measured. Results showed no significant differences between predicted and actual performance, but a trend of under- and overestimation was observed. Self-efficacy assessment methods were found to be reliable and repeatable and may be a valuable tool for modifying and adapting training routines.

Lo studio ha valutato l'affidabilità dell'autoefficacia nella previsione dello squat jump in giovani adulti. I partecipanti hanno completato un questionario e hanno eseguito tre salti. I risultati non hanno mostrato differenze significative tra le prestazioni previste e quelle effettive, ma è stata osservata una tendenza di sotto e sovrastima. I metodi di valutazione si sono rivelati affidabili e ripetibili e possono essere uno strumento prezioso per modificare e adattare le routine di allenamento.

KEYWORDS
Squat jump, self-efficacy, performance, perception
Salto, autoefficacia, prestazione, percezione

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Introduction

Physical activity (PA) plays a key role in maintaining and improving physical fitness and overall health (Bull et al., 2020; Marker et al., 2018; Warburton et al., 2006). However, PA cannot be treated as a quick fix or magic pill, as its effects depend on a several factors. For this reason, PA should be tailored to the individual's body, taking into account their unique needs. The intensity and volume of PA can have different effects on the body, so it is significant to find the right balance for everyone. The choice of the type of PA can also greatly impact its effectiveness, since different activities can target different muscle groups and have a different impact on the cardiovascular function (MacInnis & Gibala, 2017).

The structured PA, defined by Caspersen (Caspersen et al., 1985) as exercise, is often designed by sport science professionals who should schedule the routine in order to improve the efficacy of PA. However, designing the appropriate volume and intensity during the entire training period is a challenging task. Furthermore, especially in sports environments, the annual planning is often modified during the period to adapt the unique needs of the group or to address any weaknesses. In certain circumstances, it is essential for the trainer to gather feedback from the players to understand their individual perceptions of the proposed activity. Listening to individual perspectives can also be crucial in identifying any individual or group needs and can be a useful tool in modifying or adapting the activity accordingly.

On the other hand, self-evaluation of the own performance defined by Bandura as self-efficacy (Bandura, 1982, 2005; Bandura et al., 1999; McAuley, 1985) is a challenging process. Several factors affect the accuracy of self-efficacy, e.g. psychological or social aspects (Moritz et al., 2000). For instance, the mood of the day or the emotions of the moment can influence the ability to self-evaluate accurately (Schunk, 1995; Sklett et al., 2018). Additionally, the influence of the group, which may alter the perception of one's own performance, must be taken into account. The individual's background and motor skills level should also be considered since they can influence the reliability of self-efficacy. Moreover, self-evaluation solidity could be affected by the type and complexity of the skill and by the level of knowledge related to its execution. A movement or exercise too challenging or unfamiliar is difficult to be self-evaluated and this reduces the quality of the self-efficacy.

On these bases, the accuracy of the self-efficacy plays a key role in the effectiveness of training and can lead to performance improving. This could be used to help the trainer to modify and adapt the training routine but, even, to modify the topic of the section of the training required of the individual. Indeed, detecting the weaknesses and strengths (Williams & Reilly, 2000) and dedicate the appropriate amount of time to improving the less effective skills should be a good practice for any athlete or sportsman. However, overestimating the ability to perform a certain gesture can lead to a reduction of time spent in this training and should be avoided. Conversely, underestimating performance can also have a negative effect on training efficiency, as the obstinacy to ameliorate an already good skill can take time away from the improving other skills. To prevent this, trainers should provide opportunities for individuals to gain experience and evaluate their own performance.

The aims of this study are threefold: to evaluate whether the tools adopted to self-evaluate the performance of a squat jump are reliable, to understand the relationship between actual performance and under- or over-estimation, and to assess if self-efficacy assessed after actual performance is more accurate.

1. Methods

Participants

The study involved 45 healthy young adult participants (12 female) aged 23.1 ± 3.5 YO with an average weight of 69.8±10.9 Kg and an average height of 176±9 cm. None of them had neurological or orthopaedic diseases. All participants were sport science bachelor's students at the University of Bergamo, they are physically active (3797 ± 1979 MET/minute/week) but none of them were engaged in jump discipline at the time of the experiment. Written informed consent was obtained from all subjects.

Experimental procedure

Before the beginning of the experiment, a detailed explanation of the study was communicated to the participants. Then, the participants filled out a questionnaire on their own device via Google forms. The questionnaire presented a figure of the proper execution of a squat jump and asked questions about the participants' self-efficacy. The questionnaire was designed to evaluate how the participants perceived their own peak performance and how it compared to the experimental group's standards (more details are given below). Next, participants were asked to predict the maximal squat jump by indicating it on a plain rod. The rod was graduated in centimetres, however, only the researcher could see the graduations. The actual height of the squat jump was measured using an optical measurement system (Optojump Microgate Italia, BZ, Italy). To properly performed the squat jump, the subject was instructed to squat and maintain the position for 5 seconds, then, to jump as high as possible and to repeat the jump for three times. After each trial, the participant indicated on the graduated rod the perceived height of the just performed jump. Each trial was separated by 5 minutes of rest. Two weeks later, participants filled ex-novo the previous questionnaire and they were asked to complete an IPAQ questionnaire to assess their level of PA (Bassett, 2003; Lee et al., 2011; Minetto et al., 2018).

Questionnaire

The questionnaire was divided into two parts. The first part contained non-performance related questions, such as "indicate your gender," "do you play any sports," and "if yes, which ones?" The second part consisted of four questions related to the squat jump self-efficacy, each of which required a response on a Likert scale ranging from 1 to 5. The questionnaire was designed according to Bandura (Bandura, 2005). The first aimed to evaluate how confident the subject was in performing a squat jump at a specific height (height ranges were determined according to gender). The answers ranging from "not at all confident" to "extremely confident". The second question tested the participants' level of confidence in relation to their answers to the previous question. The participants were then asked to compare their performance with that of the other study participants (divided by gender). For this, the Likert scale was set as follows: 1) not good at all (below the 20th percentile); 2) not very good (between the 20th and 40th percentile); 3) moderately good (between the 40th and 60th percentile); 4) very good (between the 60th and 80th percentile); and 5) extremely good (above the 80th percentile). The final question tested the subject's confidence in all the previous answers.

Statistical analysis

Statistical analysis was conducted using Jamovi for Windows, version 2.3.23. A type I error rate of 0.05 was used to determine statistical significance. The maximal squat jump height was compared between male and female group using a One-Way ANOVA. Whereas, to verify any changes in perceived performance (measured with the rod) before and after each jump, a One-Way Repeated Measure ANOVA was used. *Post-hoc* analyses were carried out by means of Tukey's least significant difference test. To examine differences in the actual jump height and the perceived performance we used a paired t-test in both the assessment methodology (rod and questionnaire). We used paired t-test, also, to verify if any different exist between self-efficacy (measured with the questionnaire) pre and post the jump. Pearson's correlation was used to identify any under- or over-estimation of performance by examining the relationship between absolute estimation error and actual performance and to understand if the subject accurately assesses the own performance relative to others in the study group.

2. Results

The higher of the three squat jumps performed was considered as peak squat jump. The height of the jump was 30% greater in the male group (38.8 ± 6.0 cm) compared to the female (29.6 ± 6.3 cm) ($p < 0.001$; $F = 21.8$).

Self-efficacy results showing no statistical differences between the prediction of jump height and the actual performance (36.3 ± 7.3 cm) both in the questionnaire (37.1 ± 8.3cm) and in the rod (35.0 ± 9.2 cm) assessment ($p=0.393$ and $p=0.373$ respectively) as reported in Fig. 1.

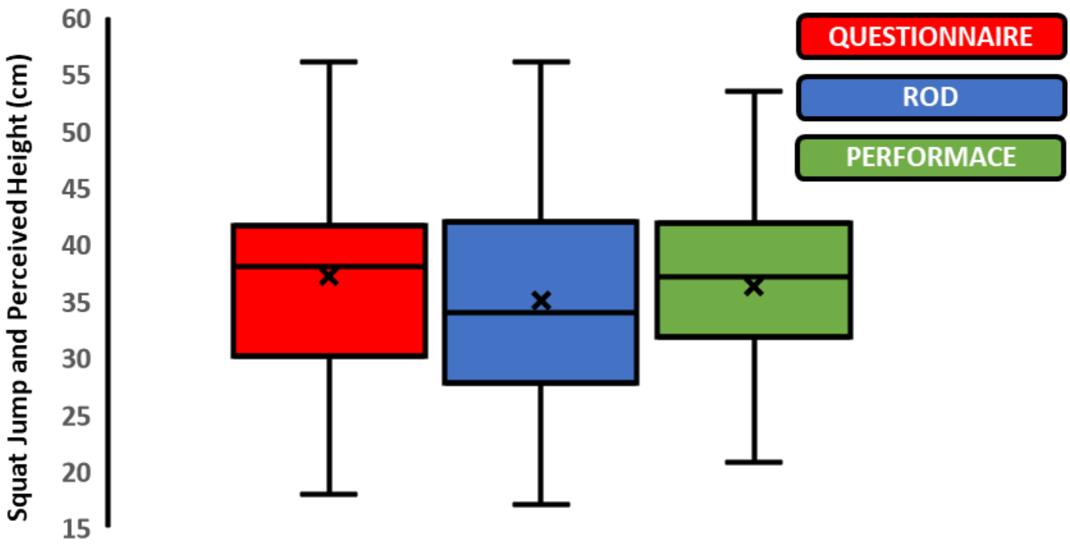

Figure 1 Distribution of the actual jump height (green) for questionnaire self-efficacy (red) and for rod self-efficacy (blue). The box plots show the 75° percentile (higher line), the 25° percentile (lower line) and the median (middle line). The whiskers show the higher and the lower absolute value. The X report the mean of the group.

A pattern of under- and over-estimation could be observed which correlates the absolute self-efficacy error with actual performance. Indeed, as shown in Fig. 2, participants who overestimated the jump performed a lower jump than the other study participants. Conversely, subjects who performed a higher squat jump tended to underestimate the height of the jump. This can be noticed with both the questionnaire (panel A) and the rod (panel B) self-efficacy assessment methodology. Person's correlation showed a quite solid coefficient between actual performance and questionnaire ($r = -0.439$; $p = 0.002$) and the rod ($r = -0.436$; $p = 0.002$) self-efficacy estimation.

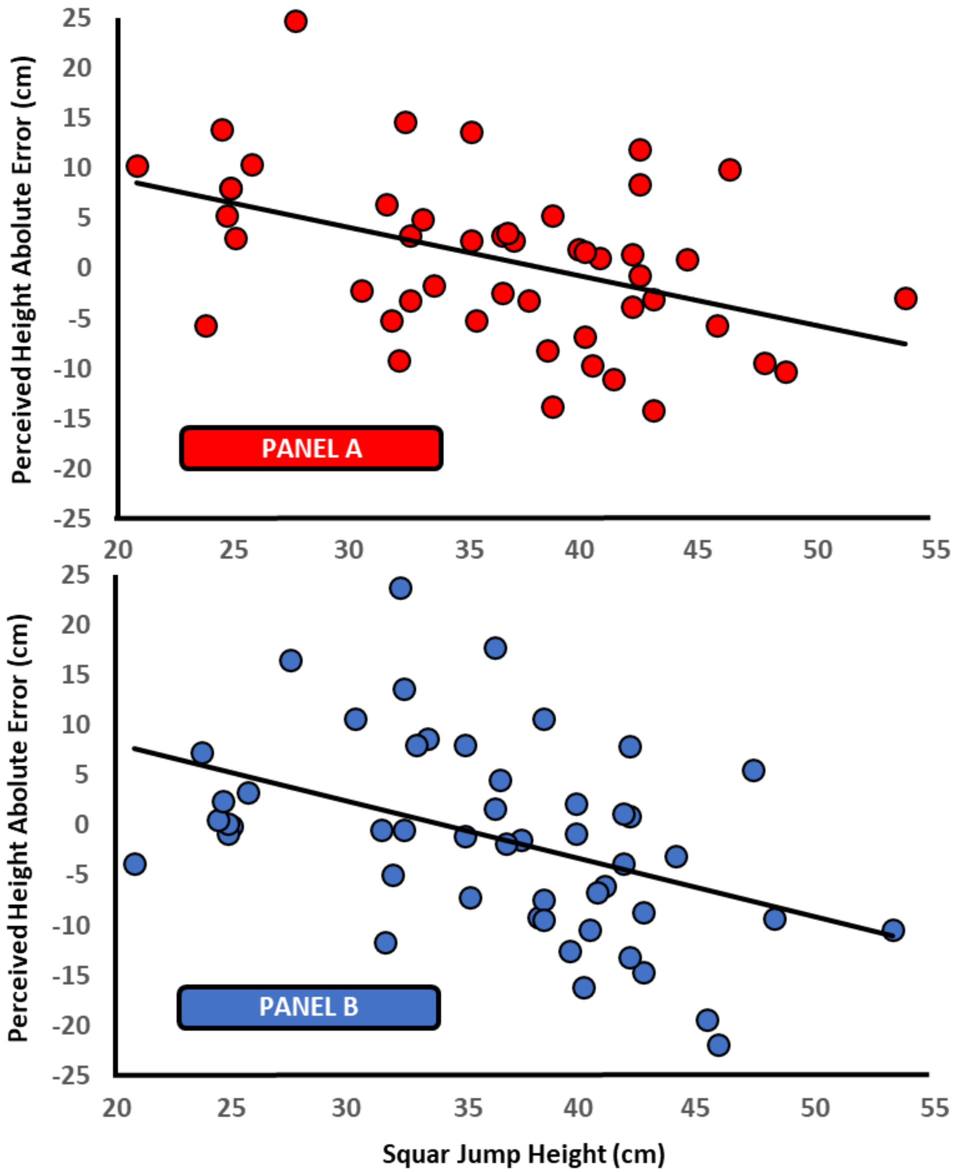

Figure 2 Pearson's correlation between actual squat jump height and absolute error calculated from self-efficacy questionnaire (pane A, in red) and from self-efficacy rod (panel B, in blue).

Interestingly, tested subjects were able to locate their performance within the contest of the group ($r = 0.493$; $p < 0.001$). However, nobody perceived the own performance below the 20th percentile and only one subject declared to be able to be above the 80th percentile.

The results shown the self-efficacy evaluated before the actual performance. This because none of the results showed any difference in the value before and after the jump (questionnaire: $p = 0.513$; rod: $p = 0.396$, $F = 0.998$).

3. Discussion

Squat jump test was used for its widely employment to evaluate the lower limb strength (Driss et al., 2001; Riggs & Sheppard, 2009; Thng et al., 2020; Van Hooren & Zolotarjova, 2017; Vizcaya et al., 2009). Even if the IPAQ questionnaire reveled that the tested subjects, were physically active or very active, they were not involved in any jump specific sport. However, Squat jump has been chosen over other jump tests (e.g. counter movement jump test) because of its peculiar characteristics (Van Hooren & Zolotarjova, 2017), which make it valid and repeatable. Indeed, the easier execution of the movement allows to evaluate (and self-evaluate) the jump in a more reliable way because the assessment of this skill is not affected by poor jump technique or muscle stiffness caused by external factors (Ando & Suzuki, 2019; McHugh & Hogan, 2004; Reid & McNair, 2004). Additionally, task-specific self-efficacy, as reported by Moritz et al. 2000, has a great correlation with performance.

The assessment of self-efficacy should account different evaluation tools. This could be a good strategy to minimize the possible bias that the evaluation instrument design can present. To overcome this issue, we decided to evaluate self-efficacy using two different methods, one digital and one analog. Considering that the measurement in centimeters could be an unfamiliar procedure to describe a jump, we asked the subjects to indicate the height of the jump on a rod. Interestingly, both questionnaire and rod self-efficacy estimations did not differ from what recorded during the squat jump. This reflects the ability of this population to self-evaluate their performance and, moreover, it corroborates the reliability of the methods we designed to evaluate self-efficacy. Furthermore, the self-efficacy reported after the actual performance was not statistically different from the previous one in the questionnaire, nor in the rod. The importance of this result is twofold: firstly, the chosen methods are repeatable, they can be undertaken at different times without the risk that can return different results; secondly, performance does not affect the acute self-efficacy evaluation. The latter is in line with Tanaka's finding (Tanaka & Watanabe, 2011) that perception and evaluation of performance do not differ pre and post task execution. However, it has been shown that a training session could improve self-efficacy. For this reason, it is highly suggested that trainers or sport science specialists use exercise as a tool to increase the competence in self-evaluate the own performance.

Even if the performance estimation is adequate, a trend of under and overestimation of the jump height can be observed. It is evident how subjects who performed a small jump overestimate the height; conversely, the subjects who can jump higher declared to be able to produce a poorer performance. This result may be explained as the subjects' attempt to align the own perception to the group. For instance, even if there is a linear correlation between the questionnaire's predicted percentile and the percentile of the actual performance, a negligible part of the sample declared their performance would have been below the 20th or above the 80th percentile.

Whether implemented and improved, an accurate self-efficacy could be a valuable tool to modify and adapt the training routine. It can be used to faster identify weakness and strength reducing the time of non-effective training and adapting the work on the need of the athlete or sportsman. Anyhow, at the experimenters' knowledge, this is the first study evaluating self-efficacy on sport science bachelor students. This should be a starting point for the implementation of the self-efficacy as a tool of consciousness, not only for the athlete but even for the teacher who can use it as a didactic tool.

The limitations of this experimental protocol are several: we considered only active young adults not involved in any jump specific sport and the female sample is scares. The results may vary with different populations and the effect of the training on self-efficacy can be described in further investigation.

Conclusions

In summary, in this study we showed that the methodology used is a solid tool that can be involved in the accurate evaluation of self-efficacy. However, it has been noted that subjects with lower performance tend to overestimate the own performance. Finally, a single activity session was not able to improve self-efficacy; further studies on the effect of training on the improvement of the perception of the own performance are needed.

Author Contribution:

A.C., conceptualization; data collection and analysis; writing original draft preparation, revision, and editing; *corresponding author.
V.A., study supervision

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