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Original article

Comparison about the Jump capacity in junior athletes

Comparación de la capacidad de salto en deportistas juveniles

Comparação da capacidade de salto em atletas juvenis

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ABSTRACT

Within the dynamics of sports training the jumping evaluation is a useful tool to determine and compare the athlete's performance. The objective of the study is to compare the jumping ability between two groups of juvenile athletes, entering university in different years. The study is of a comparative type, 120 subjects were selected by convenience, which was distributed in two groups, according to the year in which they enter the university (2015 and 2020). Jumping capacity was measured with the 90° squat, countermovement and free squat protocols. The results showed a trend (p=0.07) in the countermovement modality, where the 2020 year group possessed better performance. In conclusion, the countermovement jump is projected as the comparison variable for populations with similar characteristics.

Keywords: Athlete; Motor performance; Physical Exercise.

RESUMEN

Dentro de la dinámica del entrenamiento deportivo la evaluación de salto es una herramienta útil para determinar y comparar el rendimiento del atleta. El objetivo del estudio es comparar la capacidad de salto entre dos grupos de deportistas juveniles, que ingresan a la universidad en diferente año. El estudio es de tipo comparativo, se seleccionaron 120 sujetos por conveniencia, los cuales fueron distribuidos en dos grupos, de acuerdo con el año en el que ingresan a la universidad (2015 y 2020). Se midió capacidad de salto con los protocolos de sentadilla de 90°, contra movimiento y libre. Los resultados mostraron una tendencia (p=0,07) en la modalidad de contra movimiento, donde el grupo del año 2020 poseía un mejor rendimiento. En conclusión, el salto en contra movimiento se proyecta como la variable de comparación para poblaciones de similares características.

Palabras clave: Atleta; El rendimiento del Motor; Ejercicio Físico.

INTRODUCTION

In high competition sports, there are sequences of explosive movements of short duration, which address an important part of the dynamics of the game (Ahmaidi, Buchheit, & Spencer, 2013), such as, for example, jumps, changes of direction, speeds and decelerations (Thomas *et al*., 2020), these components involve mainly eccentric actions, capable of being reproduced as force situations linked to the success of the discipline (Harper *et al*., 2020).

Different sport activities use the maximum mechanical power of the lower limbs as a reference point, to compare the quality and quantity of force produced by athletes (Jiménez *et al*., 2009). Specifically, jumping in sport is considered a high-speed dynamic action, associated with the elevation of the body around an athletic target (Newton *et al*., 2006). In this context, vertical lifting is a multi-joint action that demands levels of power and strength, which can be assessed through the 90° squat jump (SJ) and the countermovement jump (CMJ), which, in turn, are related to explosive strength and explosive elastic strength, respectively (Markovic, & Mikulic, 2010). In the same way, the magnitudes of strength achieved during this action are related to anthropometric components and sports performance (Bustos-Viviescas, Acevedo-Mindiola, & Merchán Osorio, 2020), therefore, it is very common to use this evolution within the sports field (Castagna *et al*., 2013).

Based on the above, it is relevant to understand that the evaluation of jumping considers parameters of flight time, execution and take-off speeds, which are propitious data for training planning and determining the athlete's level (Bosco *et al.,* 1983; Di Giminiani, 2006), however, in the present study, only the height reached by the athlete will be addressed, due to the practicality generated by this variable and the greater possibility of comparison with the literature. Besides this, it allows projecting efficiency in mechanical and physiological processes, such as the production of tension, the recruitment of motor units and the frequency of nerve impulse discharge. Also, it represents the functioning of the elastic component of the muscle, which interacts with the motor control of the lifting technique (Saavedra *et al*., 2017; Claudino *et al*., 2017).

For its part, sports training leads to detailed knowledge of athletes, where evaluation turns out to be an essential tool within the progress of a subject. This allows comparing performances and establishing preparation structures that enhance the development of physical abilities (De la Rosa*, et al.*, 2020). Based on this premise, the objective of this research is to compare the jumping ability between two groups of youth athletes, who enter the university in different years, in order to identify the entry behaviors and establish the characteristics of each group according to the instances that were evaluated.

For this research some instruments were used, whose names and authors will be identified below:

- DM Jump brand contact platform (Saavedra and Vergara 2013).
- Methodology for evaluations (Bosco *et al*., 1994).

MATERIALS AND METHODS

The present study is a cross-sectional study with a comparative design. As a participant, the sample was constituted with 120 subjects, belonging to the catchment program of the Universidad Católica del Maule (UCM), Chile. They were divided into two groups, according to the year in which they were evaluated (group A=2015, group B=2020). The athletes were part of the disciplines of soccer, volleyball, basketball, handball, athletics and gymnastics (Table 1).

Table 1. - Characterization of the sample

Year of income	n	Man	Woman	Old	Weight	Size
Group A 2020	44	29	15	19,5±1,3	71,5±11,5	172±0,0
Group B 2015	76	58	18	19,7±1,7	72,6±12	170±0,1
Total	120	87	33	19,6±1,5	72,1±11,8	171±0,0

The sampling used in this article is non-probabilistic by convenience. We proceeded to review the sports record and then performed the jumping evaluations.

Within the UCM protocols, the program for recruiting athletes for admission to the institution is established. Ethical guidelines and regulations are established, which must be taken into account at the moment of proceeding with the evaluations and the handling of the data; each athlete, prior to the evaluation, must sign an informed consent form where he/she declares to have knowledge of the characteristics of the tests. The above is governed by the Helsinki treaty and the ethical regulations of said university.

The measurements were taken on the DM Jump contact platform, where the data were processed using the DM Jump V2.2 Beta software, relating the flight time with the distance reached in the jumps.

Procedure

According to the jump evaluations based on the methodology announced in the introduction of this work, the SJ, CMJ and free modalities are treated. The protocol establishes to execute the SJ with a 90° knee flexion, with the feet in parallel and the hands on the hips. For the CMJ, the subject begins in a standing position with hands on hips, and then performs a 90° knee flexion and rises. As for the free jump, there is the consideration of executing it as a comfortable way as possible and trying to resemble some technical gesture of their sport. The time between each evaluation was approximately 3 minutes.

Prior to the evaluation, the athletes performed a 10-minute warm-up, which consisted of joint movements, dynamic actions and an adaptation to the technique of each jump.

Both groups followed the established protocol and the evaluations were carried out by the same researcher.

Analysis

Statistical analysis was performed in the SPSS Statiscs 22 program. The data were subjected to a Shapirowilk normality test. Descriptive statistics of mean and standard deviation were calculated. The t-test was performed for independent samples between the groups of athletes (2015 - 2020) considering a significance value $p \leq 0.05$ and a trend $p \leq 0.07$.

RESULTS

Figure 1 shows the jumping performance of the two samples of youth athletes, evaluated in 2015 and 2020. It is observed that there is no significant difference in the SJ ($p=0.11$) and free ($p=0.28$) modalities. While in the CMJ test it is possible to observe a trend between the two groups ($p=0.07$).

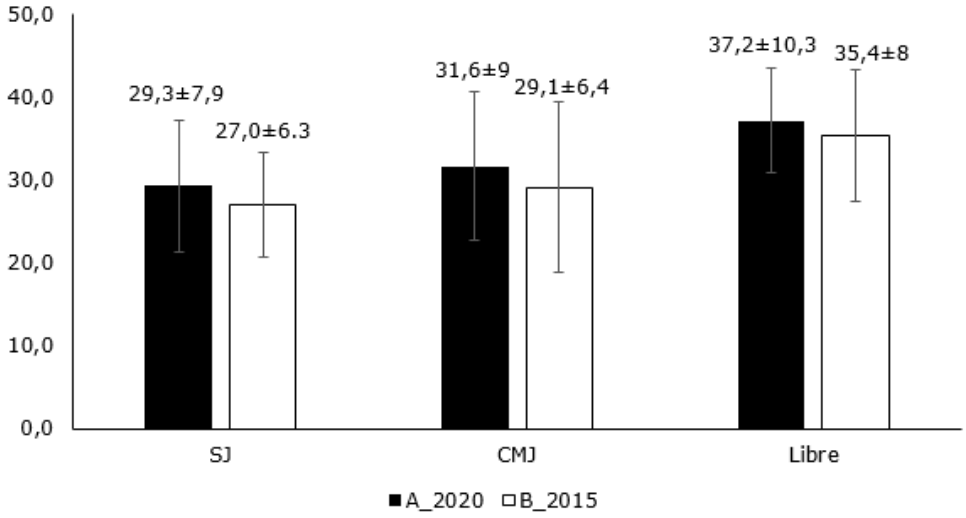

Fig. 1. - Comparison of jumps among athletes of the Universidad Católica del Maule

The present study investigated the performance of subjects belonging to the UCM recruitment program, which differed according to the instance in which they were evaluated (group A = year 2020 and group B = 2015).Therefore, the purpose of this article, lies in comparing the performance in jumping tests between the two samples of youth athletes, and thus, to be able to generate conclusions about the behavior of each group around the year in which they were measured.

DISCUSSION

The main finding of this research refers to the tendency shown by the CMJ test, which presents a higher performance of group A compared to group B. This is relevant for the analysis of sports performance, since this jump has a good prediction with the muscular power of the lower extremities (Markovic, *et al*., 2004) and its technique possesses coordinative characteristics, which are related (r = 0.9) with the mechanical speed of discipline-specific gentos (Linthorne, 2020). Along with this, Rodríguez-Rosell *et al*., (2020) determined that actions associated with CMJ have speed as an enhancer factor, which stimulates neuromuscular processes, to achieve efficiency in the movement (+9.2%). Similarly, it has been seen that plyometric stimuli generate an increase in CMJ height (+0.6 %), which is due to the characteristics of the stimulus, since it favors muscle stretching and shortening actions in a sequential manner (Franco-Márquez *et al*., 2015).

When comparing the results of the present study with the literature, it is observed that the sample of this research, has an inferior performance in the CMJ test to athletes who practice judo (43.3 ± 7.0 cm),jiujitsu (45.3 ± 4.1 cm), soccer (37.7±7.4 cm), basketball (first division 45.51 ±5.55 and second division 45.29 ±6.13) and mixed martial arts (41.6±6.1 cm) (Lima-Kons, *et al*., 2017; Pehar, *et al*., 2017; Campos, Leporce & Souto-Maior, 2019).

Regarding the results of SJ and CMJ, it can be seen that when contrasted with a group that practices BMX (bicycle motocross), at recreational level (CMJ= 48.7 ± 9.6 cm and SJ= 32.4 ± 8.1) and elite level (SJ= 50.9 ± 9.7 cm and 48.7 ± 9.6 cm) (Robert *et al*., 2020), it is possible to identify that there is a lower jumping capacity. Similarly, when comparing the data with amateur athletes (SJ = 27.41 ± 7.6 cm and CMJ=29.34 ± 8.30 cm), it is evident that group A has a higher performance, while group B, presents a lower flight height (Texeira *et al*., 2019). In the same context, Yoshimura and Umemura (2016), evaluated a group of swimmers (SJ =39±7 and CMJ= 42±7) and volleyball players (SJ=45.5 and CMJ= 50±5), which have a better performance than the athletes studied in this research.

When analyzing experimental studies, which show the improvement of jumping ability performance in a population of athletes, it has been seen that strength and coordination training, manages to improve the values of SJ (pre= 30.33 cm; post= 33.31 cm) and CMJ (pre= 31.9 cm; post= 35.25) in volleyball players (Kukiæ *et al.,* 2020). In this sense, Ramírez-Campillo *et al*., (2016), evidenced an increase in flight height (SJ= 5.1%. and CMJ=4.4 %) in female soccer players, through a plyometric intervention. Falces-Prieto *et al*., (2020), identified that U-19 soccer players increase their performance in the CMJ (pre=34.4 cm; post=37.1) with strength training with body weight load. According to these results, it is identified that UCM athletes have a lower performance, both before and after the intervention.

Among the limitations of the study is the lack of quantification of maturational parameters, which would have provided a higher level of interaction with jump height, since there is evidence that anthropometric aspects influence explosive actions such as jumps (Malina *et al*., 2004; Almaiman, 2018).

CONCLUSIONS

In conclusion, the data of the present investigation show that there are no differences in the jumping ability in the groups of young athletes who enter the university in different years. Nevertheless, the CMJ evaluation could be the projectable test to obtain concrete results that identify the performance of UCM youth athletes.

Also, it is considered relevant, the quantification of the effect of the passage of five years, between two different groups, with similar contexts.

The use of jumps is recommended to determine the performance of the subjects and thus be able to generate training protocols that enhance the performance of youth athletes.

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The authors declare not to have any interest conflicts.

Authors' contribution:
The authors have participated in the writing of the work and analysis of the documents.