

Articles

Physical fitness and competitive performance in padel: a comparison between junior and cadet players

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Abstract: Padel is an intermittent sport that requires the development of specific physical capacities during formative stages. The aim was to analyse differences in physical fitness according to competitive level in young padel players from under fourteen and under sixteen categories. A cross-sectional comparative study was conducted with 38 male federated players aged between 13 and 17 years. Participants were classified as elite or amateur according to their position in the official ranking. Anthropometric variables, sport experience, handgrip strength, and vertical jump performance assessed through countermovement jump and countermovement jump with arm swing were evaluated. A two-factor analysis of variance was applied to compare category and competitive level. Elite players showed higher values $p < 0.05$) in handgrip strength and jump performance in the younger category. In addition, older players presented greater values than younger players within the amateur level ($p < 0.05$). In the older category, significant differences between competitive levels were observed only in handgrip strength, whereas jump variables showed non-significant trends. It was concluded that upper limb strength and lower limb explosive power were associated with better competitive level in the younger category, while their influence decreased in the older category. These findings suggested that early development of strength and power could contribute to competitive performance in young padel players

Keywords: padel; physical fitness; grip strength; vertical jump; athletic performance; developmental stage.

Introduction

Padel is a racket sport characterized by its intermittent nature, combining short-duration high-intensity actions with incomplete recovery periods (Martín-Miguel et al., 2023). These characteristics determine specific physical demands that include repeated accelerations, changes of direction, explosive actions of the upper and lower body, as well as adequate postural control and intermittent endurance capacity (Martín-Miguel et al., 2024). In recent years, the growth of padel has been especially notable in Spain, where it has become one of the most practiced sports disciplines both in competitive and recreational settings, with a significant increase in federation licenses and participation at early ages (Consejo Superior de Deportes, 2025).

From a performance perspective, physical fitness has been identified as a determining factor in racket sports such as tennis or squash, where variables like explosive strength, movement speed, and muscle power are associated with competitive level (Gallardo et al., 2023). In the specific case of padel, studies conducted on adult populations have shown that players of higher competitive level present better values in vertical jump tests, handgrip strength, and acceleration capacity, suggesting that these physical components may play a relevant role in performance (Courel-Ibáñez & Herrera-Gálvez, 2019).

However, the available evidence in young populations is still limited and shows inconsistent results. While some studies have pointed out differences in strength and power variables between competitive levels, other works have not found clear associations between physical fitness and competitive performance in formative stages (Courel-Ibáñez & Llorca-Miralles, 2021). These discrepancies could be explained by factors related to biological maturation, training experience, or heterogeneity in assessment methods.

Considering the growth of padel at early ages and the need to identify physical factors associated with performance at these stages, the aim of this study is to analyze differences in physical fitness between elite-level competitive padel players compared to lower-level federated players in the under fourteen and under sixteen categories.

Material and Method

A cross-sectional comparative study was carried out with the aim of analyzing physical fitness in padel players aged between 13 and 17 years during the 2024/2025 season.

Participants

A total of 38 male federated players belonging to the Madrid Padel Federation, distributed in under fourteen ($n = 20$) and under sixteen ($n = 18$) categories, were included in the study.

All participants and their legal guardians were informed verbally and in writing about the objectives and procedures of the study, signing the informed consent. Likewise, authorization was obtained from the SOMPADEL padel center (Community of Madrid, Spain) where the measurements were carried out following the established protocol, in accordance with the Declaration of Helsinki.

Instruments

Training experience (years), competitive experience in federated settings (years), and ranking position at the time of evaluation were collected through an ad hoc questionnaire designed by the researchers. This information was subsequently verified with the corresponding clubs and contrasted with the official ranking of the Madrid Padel Federation. For statistical analyses, the "elite" group was created, comprising players within the top 16 positions of the Madrid Padel Federation ranking in their category. The remaining players with federation licenses were grouped as "amateur."

Anthropometric variables were evaluated prior to performing physical tests. Height was measured using a portable Seca 2017 stadiometer, while body weight was recorded with a calibrated Seca 803 scale without shoes and with minimal clothing (pants, shirt, and underwear) following

the standardized protocol by Marfell-Jones et al. (2006). From these measurements, body mass index (BMI) was calculated as the ratio between body weight (kg) and height squared (m^2).

Before evaluation, participants performed a standardized 10-minute warm-up that included low-intensity continuous running, joint mobility, and neuromuscular activation exercises.

Handgrip strength was evaluated using an analog dynamometer (Takei TKK 5401, Takei Scientific Instruments Co., Ltd., Japan) with adjustable handle. Following previously validated standardized protocols (Roberts et al., 2011), participants adopted a standing position with the arm extended along the body, avoiding any compensation with the trunk or lower limbs. After the start signal, they performed a maximum voluntary contraction sustained for 3–5 s. The dominant hand was evaluated, performing three attempts with one minute of recovery between them. The maximum recorded value was considered for analysis.

Countermovement jump (CMJ) was evaluated using the MyJump2 application (iOS version, Apple Inc., Cupertino, CA, USA), previously validated for jump height measurement (Vieira et al., 2023). Players started from an upright position, with hands on hips to eliminate upper body contribution. Participants performed an eccentric phase until approximately 90° of knee flexion, followed by explosive extension. During the flight phase, the trunk remained upright, and reception was performed with knee extension and plantar flexion (Claudino et al., 2016). Two attempts were performed, considering the best result. If the difference between both exceeded 10%, a third attempt was performed. All attempts that did not comply with the protocol were considered void.

Countermovement jump with arm swing (ABK) was executed under the same conditions as the CMJ, allowing free use of the arms to maximize performance (Luna-Villouta et al., 2021). The same technical and validity criteria were maintained, as well as the number of attempts and the procedure for selecting the best record.

Statistical Methods

Data were recorded in a spreadsheet (Microsoft Excel 2021, Microsoft Corp., Redmond, WA, USA) and analyzed using IBM SPSS Statistics software (version 29.0; IBM Corp., Armonk, NY, USA). A descriptive analysis of all variables was performed, expressing data as mean, segmented by category and competition level of the players.

Data normality was checked using the Shapiro–Wilk test and homogeneity of variances using Levene's test. For inferential analysis, a two-factor ANOVA (category $\times$ competitive level) was applied. In case of significant effects, post hoc comparisons with Bonferroni correction were performed. The significance level was set at $p < 0.05$.

Results

Descriptive Analysis

Table 1 presents the characteristics of participants according to category (under fourteen, under sixteen) and competitive level (amateur, elite). The sample consisted of 38 federated players from the Community of Madrid.

In most variables, elite-level players showed higher values in age, weight, height, sports experience, and physical performance compared to their amateur counterparts within each category.

Grip Strength and Competition

Figure 1 shows grip strength according to category and competitive level. Significant differences were observed between the two competition levels within the under fourteen categories, with higher values in the elite group compared to amateur. Likewise, under sixteen amateur players presented significantly higher values than under fourteen amateurs. No significant differences were detected between the elite level groups of both categories.

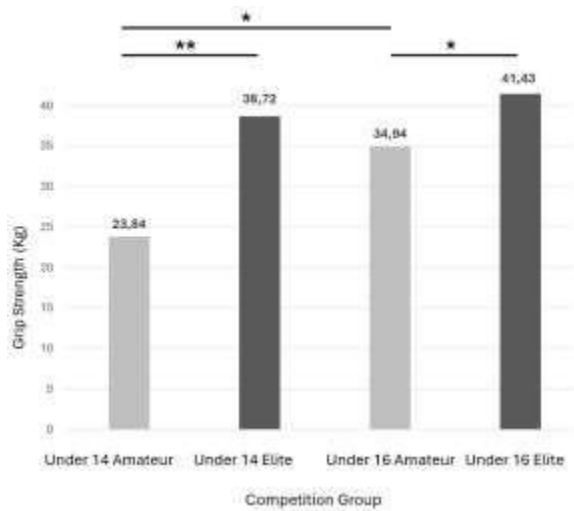
Table 1.
Characteristics of Participants

Variable	Under 14 Amateur (n=14)	Under 14 Elite (n=6)	Under 16 Amateur (n=11)	Under 16 Elite (n=7)
Age, years	14.62	15.79	16.79	17.63
Weight, kg	41.95	52.82	55.86	67.25
Height, cm	154.57	169.60	168.79	174.45
BMI, kg/m ²	17.52	18.27	19.51	21.99
Training, years	3.42	4.12	4.55	4.85
Competition, years	2.23	2.74	2.72	3.47
HGS, kg	25.84	38.72	34.94	41.43
CMJ, cm	25.45	31.80	30.89	32.00
ABK, cm	32.15	38.70	35.15	38.85

Note. Data presented as mean according to category and competition level. Abbreviations: BMI (Body Mass Index); HGS (Hand grip strength); CMJ (Countermovement jump); ABK (Abalakov jump)

Figure 1.

Differences in grip strength according to level and category



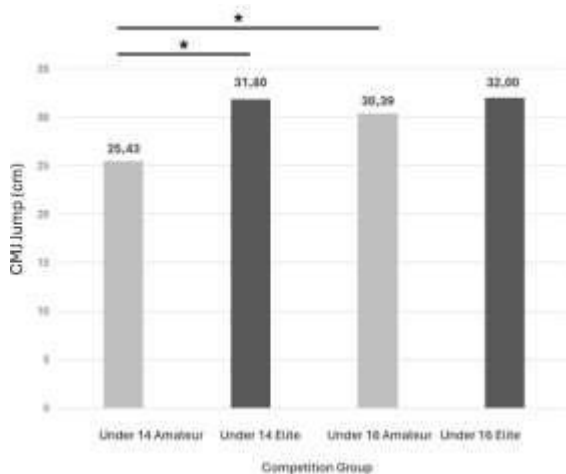
Note. Data presented as mean according to category and competition level. * $p < 0.05$; ** $p < 0.01$. Own Elaboration

CMJ and Competition Level

Figure 2 presents the vertical jump capacity values (CMJ). Significant differences were observed between both groups in the under fourteen category, with higher values in the elite group. Furthermore, under sixteen amateur players showed higher values than under fourteen amateurs. No significant differences were found in under sixteen players when comparing groups, nor among elite-level players of both categories.

Figure 2.

Differences in CMJ jump according to level and category



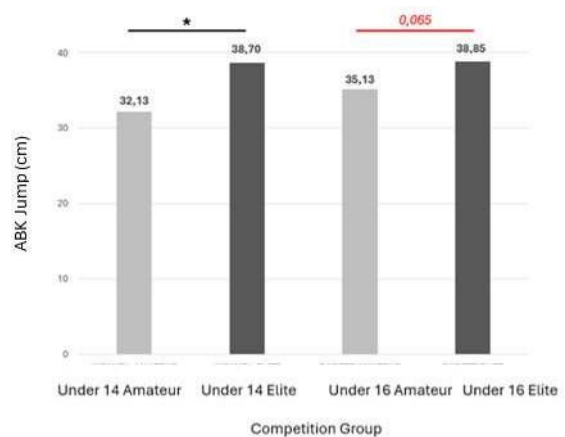
Note. Data presented as mean according to category and competition level. * $p < 0.05$; ** $p < 0.01$. Own Elaboration

ABK and Category

Figure 3 shows the results of countermovement jump with arm swing (ABK). In the under fourteen category, the elite group presented significantly higher values than the amateur group. In the under sixteen category, a trend toward higher values was observed in the elite group, without reaching statistical significance ($p = 0.065$). No differences were identified between categories within the same competitive level.

Figure 3.

Differences in ABK jump according to level and category



Note. Data presented as mean according to category and competition level. * $p < 0.05$; ** $p < 0.01$. Own Elaboration

Discussion

The aim of this study was to analyze whether there are differences in physical fitness between developing padel players according to their competitive level. The main findings indicate that players with better ranking positions, especially in the under fourteen category, present higher values of handgrip strength and vertical jump capacity (CMJ and ABK) compared to lower-level players. However, these differences tend to reduce in the under sixteen category, where significant differences are only observed in grip strength, while in jump variables only trends without reaching statistical significance are identified.

Handgrip strength showed higher values in players of higher competitive level, with these differences being more pronounced in the under fourteen stage. This finding could be explained by the relevance of the upper body in padel performance, due to its association with hitting speed, racket stability, and technical control during rallies (Courel-Ibáñez & Herrera-Gálvez, 2019; Castillo-Rodríguez et al., 2014). Likewise, the increase in grip strength with age observed between categories could be influenced by maturational development and increased training experience, determining factors in the improvement of physical performance during adolescence (Izquierdo & Ibañez, 2017).

Jump capacity, used as an indicator of lower limb explosive strength, showed differences between competitive levels in the under fourteen categories. These results suggest that, in early stages of development, lower limb explosive strength may play a relevant role in performance, as has been observed in other racket sports, where muscle power facilitates rapid movements and changes of direction (Zhang et al., 2025). However, in the under sixteen categories, no significant differences were observed between competitive levels. This finding could indicate that, as age and experience increase, other factors such as tactics, decision-making, or competitive experience acquire greater relevance in performance, reducing the relative weight of physical fitness.

This study presents some limitations that should be considered. First, the relatively small sample size, especially in higher competitive level groups, may have limited the detection of significant differences. Likewise, variables such as maturational status, multi-sport practice, or training volume were not controlled, factors that may influence physical performance during

adolescence. Future research should include larger samples, incorporate biological maturation indicators, and analyze other relevant variables such as speed, agility, or acceleration capacity.

From a practical perspective, the results suggest that the development of upper body strength and lower body power, especially at early ages, could be related to better competitive performance. In this sense, training programs that combine technical-tactical work with structured development of physical capacities could constitute an effective strategy for improving performance in young padel players.

Conclusion

In conclusion, handgrip strength and lower body power appear to be associated with a better ranking position during the under fourteen stage. However, in the under sixteen categories, this relationship is reduced, remaining only in upper body strength and disappearing in lower body power, suggesting a greater influence of other factors on competitive performance in more advanced stages of development.

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Declaration of No Conflicts of Interest

The authors declare that there is no conflict of interest of a financial, commercial, institutional, or personal nature that could have influenced the results or the interpretation of the data presented in this study.

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