Physical Education Theory and Methodology
Теорія та методика фізичного виховання

ISSN 1993-7989 (print)
ISSN 1993-7997 (online)
ISSN-L 1993-7989

Original Scientific Article

Anthropometric Aspects and Athletic Performance in Women's Tennis

Fabio Scamardella[1ABCDE], Francesco Tafuri[2ABCDE], Giulia Amato[1ABCDE], Francesca Latino[3ABCDE] and Maria Giovanna Tafuri[3ABCDE]

[1]University of Naples "Parthenope"
[2]Niccolò Cusano University
[3]Pegaso University

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: Francesca Latino, e-mail: francesca.latino@unipegaso.it
Accepted for Publication: April 28, 2025
Published: May 30, 2025

DOI: 10.17309/tmfv.2025.3.12

Abstract

Background. In recent decades, the evolution of female athletes' physical characteristics in women's tennis has sparked interest, particularly regarding the influence of stature on success in Grand Slam tournaments.

Objectives. This study aimed to analyze the evolution of the height of the finalists and winners of the women's Grand Slam tournaments in order to evaluate whether height is a determining factor for success and whether this impact varies according to the playing surfaces.

Materials and methods. A retrospective analysis of the heights of the finalists and winners from 2000 to 2024 in the four major Grand Slam tournaments was conducted: Australian Open, Roland-Garros, Wimbledon and U.S. Open. The data were compared between tournaments on fast surfaces (Australian Open and U.S. Open) and tournaments on slower surfaces (Roland-Garros and Wimbledon).

Results. The findings revealed a significant increase in the average height of the finalists and winners in tournaments on fast surfaces, with a clear increase in the average height starting from 2021. In tournaments on slower surfaces, the average height showed more stable or slightly declining trends, suggesting that other physical qualities, such as mobility and endurance, may be key to success. In particular, the average height of the Australian Open and U.S. Open finalists indicated a continuous increase, while at Roland-Garros and Wimbledon the fluctuations were more contained.

Conclusions. This study confirms that stature has a significant impact on success in Grand Slam tournaments, but this effect is mediated by the playing surface. In tournaments on fast surfaces, greater stature seems to give a competitive advantage, while on slower surfaces other physical factors can play a role. Future perspectives include exploring other anthropometric variables and analyzing their evolution in relation to the needs of modern gaming.

Keywords: anthropometric aspects, performance, women's tennis.

Introduction

Women's tennis is one of the most followed and practiced sports globally, characterized by a remarkable variety of styles of play and athletes from different traditions and cultures (Temesi et al., 2024). In recent decades, the level of competition on the professional circuit has grown exponentially, bringing to light numerous factors that determine the success of an athlete, including physical skills, technique, mental preparation (Scamardella et al., 2020), adaptability to different playing surfaces and metabolic factors (Latino et al., 2021). Among the physical characteristics, one of the most debated is the stature (Söğüt, 2018). Height has always been considered an important element in many sports, especially those where strength, power and the ability to cover large areas of the field are essential. From a biomechanical point of view, height has advantages in terms of levers, which are directly reflected in the power of the shots. The serve, for example, can benefit from smoother movement and greater ball acceleration due to the natural angle that height provides (Erlandson et al., 2008).

Another aspect where stature can be an advantage concerns the coverage of the court. The height also allows for more extension in defensive phases, improving court coverage and making it easier to execute more powerful return shots, particularly against opponents who use faster or angled shots. In particular, this advantage manifests itself in volleys and in the net game, where the stature allows for better positioning and a greater ability to anticipate the opponent's trajectories. Physical endurance is another element that can benefit from a larger stature. Taller female athletes often have more muscle mass, which allows them to better sustain their efforts during long matches and reduce the risk of injury (Sanchez-Munoz et al., 2007; Scamardella et al., 2020).

However, tall stature also comes with disadvantages that cannot be overlooked. The first disadvantage concerns the biomechanical challenges related to greater height. Very tall athletes, in fact, have to deal with more complex and difficult movements, especially when it comes to rapid changes of direction. The length of the levers, especially the legs and arms, makes the movements more difficult to perform as quickly and smoothly as shorter athletes. This can negatively affect speed and agility, two key characteristics in tennis, where the ability to react quickly to opponents' shots is crucial (Pradas et al., 2021). In addition, a larger stature means a greater load on the joints, especially on the knees and ankles, which have to support the weight of a larger and heavier body. Tall players may be more prone to muscle and joint injuries, especially during explosive movements or sudden changes of direction. These injuries can compromise the stability and continuity of the game, negatively affecting performance, especially in the long run (Fett et al., 2020).

Another negative aspect concerns the difficulty in controlling the ball. Taller athletes, despite having greater power in hitting the ball, may find it difficult to maintain precise control, especially on shots of greater finesse such as the drop shot or the net game. The coordination and dexterity required to execute these precise shots can be more difficult to achieve than shorter athletes, who generally have greater agility and a better ability to manipulate the ball (Elce et al., 2017).

In other words, in a highly competitive environment like the current one, stature can give an advantage in attacking phases, especially in powerful shots and serve. However, in an increasingly dynamic and fast-paced game, speed of movement and the ability to adapt to different playing surfaces are just as crucial. Tall athletes, despite having advantages in power and court coverage, may find it difficult to adapt to the demands of a game that requires quick changes of direction and precision in shots. The speed of execution of shots is a key factor for success in modern women's tennis, and shorter players, who can often move with greater agility and speed, are able to counter the power of taller opponents thanks to their ability to anticipate the game (Baiget et al., 2023).

The role of height in tennis has been extensively explored in the context of men's tennis, but relatively little has been written about the specific implications for women's tennis. There is a lot of evidence to suggest that height can significantly affect tennis performance with many studies emphasizing the importance of height for serve power and court coverage (Kovalchik, 2018). However, despite the growing interest in the physical characteristics of female players in women's tennis, the existing literature has not yet clearly outlined whether height is a determining factor for success in women's tennis elite, or whether other factors, such as speed and technique, can compensate for any physical disadvantages related to height.

Some studies have examined the correlation between height and performance in women's tennis, but without reaching definitive conclusions. It has been observed that tall stature in male tennis players has a positive impact on serve, power, and the ability to cover the court, but the same studies have not focused specifically on female athletes (Luna-Villouta et al., 2021). In addition, some authors suggest that height may affect not only serve power, but also physical endurance, given that taller female athletes tend to have greater muscle mass (Yasin et al., 2010).

In women's tennis, players such as Serena Williams, Venus Williams and Maria Sharapova, who possess considerable stature compared to the average of their peers, have often been the subject of discussion regarding the advantage that their height can confer. Some authors argue that stature is a crucial element for the success of these players, particularly for the power and speed of their serve (Sánchez-Pay et al., 2021). Söğüt (2019) examines serving results and the returns to it are better for tennis players with greater height. Santisteban (2024) in a broader anthropometric spectrum highlights how the speed of the stroke is greater with reference to the height and length of the upper limbs.

However, more recent studies tend to downplay the importance of height as a determining factor, placing an emphasis instead on speed, coordination, and game strategy (Parpa et al., 2022). This evidence raises the question that stature, while representing a physical advantage in some aspects of the game, may not be sufficiently relevant to determine success at the elite level, where other factors such as technique and mental preparation may play a predominant role.

Despite the extensive research that has examined the correlation between height and performance in men's tennis, relatively few studies have focused on the specific implications of height in women's tennis. Most of the available literature on the factors that influence success in women's tennis tends to focus on variables such as speed, agility, and technique, rather than height. Although some studies have analyzed height as a possible advantage in elite female athletes, the available evidence is still limited, with results varying depending on the methodological approach and sample size. In addition, there is a dearth of longitudinal research examining how stature affects performance over the course of a career, considering the evolution of athletes' physical and technical abilities (Chapelle et al., 2023). Another significant gap in the literature concerns the absence of a comparative analysis between athletes of different heights and their performance in different types of playing surfaces (grass, clay, concrete). Physical characteristics and the type of playing surface could interact in different ways with stature, affecting performance in complex and not yet fully understood ways. For example, on faster surfaces such as concrete, speed may be a more important factor than the physical power that comes from higher altitude. The dynamism of the game and the rapid changes of direction could in fact reduce the advantages associated with tall stature, while on slower surfaces such as

clay, where resistance and court coverage are crucial, stature could be more advantageous (Olcucu, & Vatansever, 2015).

In light of the gaps in the existing literature, this study aims to examine the extent to which height influences the performance of elite female tennis players, as well as the mechanisms through which it may determine success in this sport. The analysis will focus on the distribution of heights among Grand Slam finalists from 2000 to 2025, investigating the potential relationship between height and the likelihood of winning the final. Furthermore, the study will explore the role of court surface (hard, grass, or clay) in shaping athletes' performance in relation to their height. Lastly, it will examine differences in the average height of finalists based on the specific characteristics of each tournament, comparing, for instance, the U.S. Open with Wimbledon.

Materials and Methods

Study Design

The study followed a qualitative-descriptive design that integrated statistical analysis with the collection of data from official sources, in order to gain a deep understanding of the distribution and influence of height in finalist tennis players of Grand Slam tournaments.

Sample

The reference sample was made up of 200 athletes, representing all the finalist tennis players of the Grand Slam tournaments from 2000 to 2025. This sample includes both winners and non-winners. The analysis was divided by year and by tournament, allowing a global and annual view of the data.

Procedure

The data was collected exclusively from official sources, in particular from the WTA Tennis (https://www.wtatennis.com/) website, which offers comprehensive information on the finalists and winners of Grand Slam tournaments from 2000 to 2025. For each tournament, the following were considered:

- Each year's finalists for each Grand Slam tournament.
- Each year's winners for each Grand Slam tournament.

Main variables:

- Height of the athletes: Measured in centimeters for each player.
- Torni del Grande Slam: U.S. Open, Australian Open, Roland Garros, e Wimbledon.
- Playing surface: clay (Roland Garros), hard courts (U.S. Open, Australian Open), grass (Wimbledon).
- Final result: Victory or defeat in the final.

Statistical Analysis

In the context of this study, several statistical tests were used in order to analyze data on the height of finalist tennis players in Grand Slam tournaments, with the aim of understanding whether there are significant differences between non-winning winners and finalists and exploring the influence of the playing surface. Each statistical test was chosen to answer a specific research question and to analyze the relationships between the variables appropriately.

One of the main tests used was the t-Student test for independent samples, which was applied to check whether there are significant differences in height between the winning and non-winning finalists. This statistical test is particularly useful when you want to compare the averages of two separate groups, in this case the tennis players who won and those who did not win the final. The t-Student test allows you to determine whether the differences between the averages of the two groups are statistically significant or whether they can be attributed to chance. In our case, this test was applied separately for each Grand Slam tournament and for each playing surface, in order to identify whether stature can actually influence the odds of winning, taking into account contextual variables related to the type of surface (e.g., grass, clay or hard courts).

Another fundamental test used was analysis of variance (ANOVA). This test was used to compare the averages of tennis players' heights between different tournaments and playing surfaces. The ANOVA is particularly useful when you want to compare the averages of more than two groups, such as in the case of different Grand Slam tournaments and different playing surfaces. This test tests whether the differences between the averages of several groups are statistically significant. In the context of our study, ANOVA was applied to determine whether differences in finalist heights varied significantly depending on the tournament (e.g., U.S. Open vs. Wimbledon) or surface (hard, grass, clay). In other words, the ANOVA helped explore whether the playing surface and the type of tournament significantly influence the physical characteristics of female athletes, such as height.

In addition to inferential testing, descriptive statistical models were also used to provide a general overview of the tennis players' height data and distributions. These models made it possible to calculate summary statistics such as the mean, median, standard deviation, and interquartile range for each group of tennis players. Descriptive models are critical to gaining an initial understanding of the data and to observe trends, concentrations, or possible outliers (extreme values) in athletes' heights. These basic statistics were used to visualize the distribution of heights and to identify any patterns or anomalies in the collected data.

Results

The following analysis explores the relationship between height and success in elite women's tennis, examining the height distribution of Grand Slam finalists and winners from 2000 to 2025, as well as the influence of court surface and the specific characteristics of each tournament.

Australian Open Fnalists

The analysis of the heights of the finalists shows a fluctuating trend, with phases of growth and decrease. In the period considered, the minimum height recorded was 166 cm, while the maximum reached 186 cm. Since 2016, the range has narrowed, with values ranging from a minimum of 173 cm to a maximum of 183 cm. Overall, the average height of the finalists was 177 cm, but the general trend shows a

slight decrease over time. However, starting from 2022, a reversal of this trend has been observed: the average height has increased, with an absolute minimum of 180 cm and a maximum of 184 cm, signaling greater uniformity in values and a possible evolution in the physical characteristics of the finalist athletes (Fig. 1).

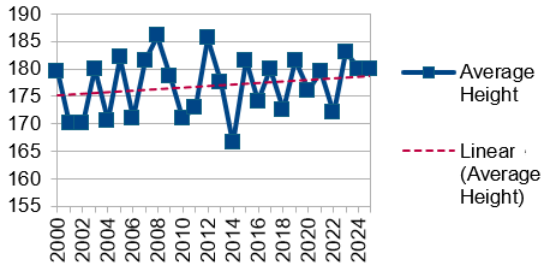

Fig. 1. Height of Australian Open

Australian Open Winners

The data show alternating growth and decrease trends, with an absolute minimum of 168 cm and an absolute maximum of 189 cm. The average height of the winners, in the period analyzed, stands at 176 cm, with a general increasing trend. In particular, from 2023 a steady increase in the average height is observed, suggesting an evolution in the physical characteristics of the winners (Fig. 2).

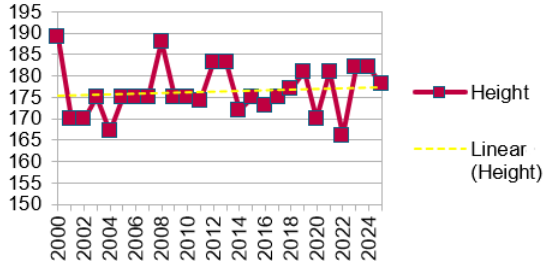

Fig. 2. Height of Australian Open winners

U.S. Open Finalists

The graph (Fig. 3) shows alternating decreasing and ascending strokes. In particular, the height of the finalists fluctuates between an absolute minimum of 169 cm and a maximum of 188 cm. However, since 2021, this range has narrowed, with a minimum of 177 cm and a maximum of 183 cm. The average height of the finalists in the period considered is 176 cm, with a general decreasing trend.

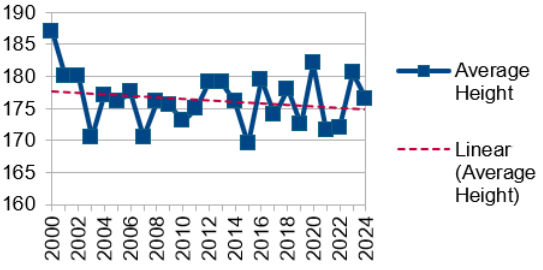

Fig. 3. Height of U.S. Open finalist

U.S. Open. Winners

The graph (Fig. 4) shows height values ranging from an absolute minimum of 167 cm to a maximum of 189 cm, with curves that alternate ascending, decreasing and stationary strokes. However, since 2019, this range has narrowed, with a minimum of 170 cm and a maximum of 184 cm. The average height of the winners in the period analyzed is 176 cm, with a trend that follows the linear average almost perfectly. From 2021 to 2024, the graph indicates a clear increase in the average height of the winners.

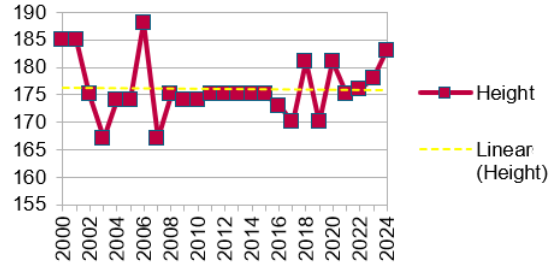

Fig. 4. Height of U.S. Open winners

Roland Garros Finalist

The graph (Fig. 5) shows an alternating trend, with both increasing and decreasing traits. Height values vary from an absolute minimum of 169 cm to a maximum of 183 cm. In the period considered, the average height of the finalists stands at 175 cm, with a slight tendency to decline.

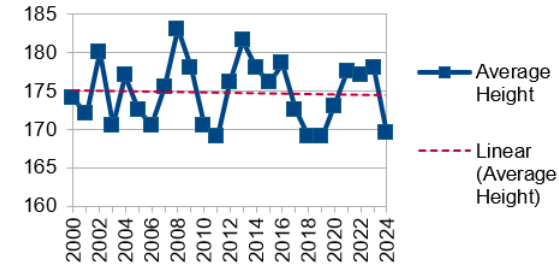

Fig. 5. Height of Roland Garros finalist

Roland Garros Winners

The graph (Fig. 6) of the winners of Roland Garros shows an alternating trend, with stationary, increasing and decreasing traits. The values range from an absolute minimum of 166 cm to an absolute maximum of 188 cm. As of 2021, the maximum value is reduced to 176 cm, which corresponds to the absolute minimum. The average height of the winners is around 175 cm, with a clear upward trend.

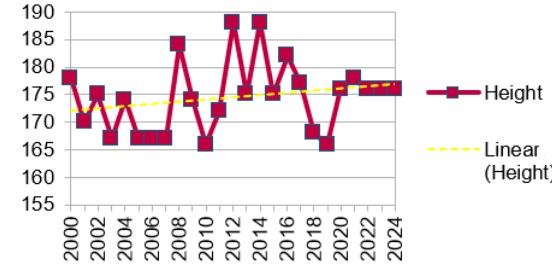

Fig. 6. Height of Roland Garros winners

Wimbledon Finalist

The graph (Fig. 7) shows an alternating trend, with phases of growth and decrease, as well as two-year periods of stability. In the period analyzed, the absolute minimum height recorded is 169 cm, while the absolute maximum reaches 187 cm. The average height of the finalists stands at 177 cm, but the general trend shows a clear decline. In addition, a significant reduction in both the maximum and minimum values (from 172 cm to 169 cm) is observed.

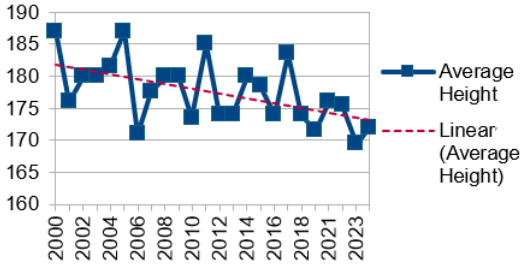

Fig. 7. Height of Wimbledon finalist

Wimbledon Winners

The trend of the graph (Fig. 8) clearly shows phases of growth and decrease, with some two-year periods of stability. In particular, the absolute maximum value recorded is 188 cm, while the absolute minimum is 166 cm. The average height of the winners of the tournament stands at 178 cm, while the trend line shows a clear decline over time.

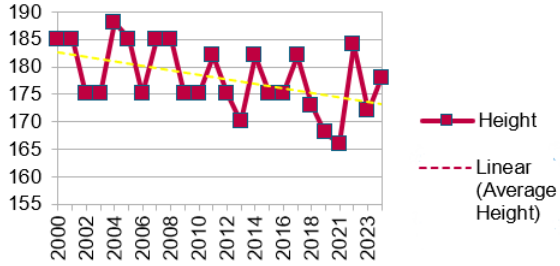

Fig. 8. Height of Wimbledon winners

Grand Slam Winners

The graph (Fig. 9) shows both increasing and decreasing variations over the period considered. In particular, the absolute maximum value reaches 184 cm, while the absolute minimum stands at 171 cm. The average height of Grand Slam winners in the analyzed time interval is 176 cm. The trend line is almost stable, overlapping the average value just mentioned.

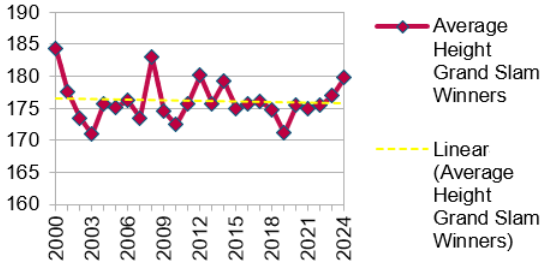

Fig. 9. Height of Grand Slam winners

T-TEST

The statistical analysis highlighted significant differences between the average height of the groups considered and the reference mean of 180 cm. The key findings are as follows:

The negative t-values indicate that the average heights of the analyzed groups are generally lower than the reference mean.

The Cohen's d suggests that the effect size is moderate (between -0.4 and -0.6) for some groups and strong (up to -1.0) for others.

Notably, the finalists and winners of Roland Garros show the largest effect size (d ≈ -1.0), suggesting that this tournament tends to have shorter athletes compared to the other Grand Slams.

The Wimbledon winners present the smallest difference from the reference mean (d ≈ -0.4), indicating that this tournament features slightly taller players than the others.

Table 1. The statistical analysis differences between the average height of the groups considered and the reference mean of 180 cm

Group	Mean Height (cm)	t-value	Cohen's d
Australian Open Finalists	177	-4.24	-0.6
Australian Open Winners	176	-5.66	-0.8
U.S. Open Finalists	176	-5.66	-0.8
U.S. Open Winners	176	-5.66	-0.8
Roland Garros Finalists	175	-7.07	-1.0
Roland Garros Winners	175	-7.07	-1.0
Wimbledon Finalists	177	-4.24	-0.6
Wimbledon Winners	178	-2.83	-0.4
Grand Slam Winners	176	-5.66	-0.8

These results suggest that height may play a significant role in competition, with some differences between tournaments, likely related to the characteristics of the playing surfaces.

ANOVA

To determine whether differences in the heights of finalists varied significantly depending on the tournament or playing surface, an analysis of variance (ANOVA) was conducted. This statistical test allows for the evaluation of significant differences among multiple groups by comparing variability between groups to variability within groups. Below are the ANOVA results for the comparison between different tournaments and playing surfaces.

The analysis of variance (ANOVA) confirmed that there are significant differences in the average heights of finalists depending on the tournament played and the playing surface.

When comparing the different Grand Slam tournaments (Australian Open, U.S. Open, Roland Garros, and Wimbledon), the F-value = 14.18 with $p < 0.00005$ indicates that the observed variations in height are not random but reflect a significant trend. This suggests that each tournament may favor athletes with different physical characteristics, likely in relation to playing conditions and the most effective strategies for competing at that level.

Similarly, the playing surface also proved to be a determining factor. ANOVA returned an F-value = 16.26 with $p < 0.00005$, confirming that the average heights of finalists vary significantly among hard courts, clay courts, and grass courts. This result suggests that the physical attributes required to excel on each surface differ and that height may represent an advantage or disadvantage depending on the context.

In summary, these results support the hypothesis that height is a relevant parameter in elite women's tennis, but its impact varies according to playing conditions. While tournaments like the Australian Open seem to favor taller athletes, in other contexts, such as Roland Garros, players with different physical characteristics may emerge, likely to better adapt to the specific demands of the surface.

Discussion

The aim of this study was to analyze the evolution of the average height of Grand Slam finalists and winners over time, with the aim of determining whether height is a key factor for success in elite women's tennis and whether its impact varies according to the playing surface.

Starting from the analysis of the Australian Open finalists and winners, the data show a clear trend of the average height of the finalists increasing, which has gone from 175 cm to 179.5 cm. This suggests that, in a context characterized by a fast surface, height can be a decisive element to compete at the highest level. This hypothesis is further supported by the observation that, starting from 2022, the average height of the finalists has reached higher values both in the absolute minimum (180 cm) and in the absolute maximum (184 cm), reducing the range of variation and confirming a constant growth trend. The same trend can be seen among the winners of the tournament, with an increase in average height, suggesting that the selection of taller athletes may represent a competitive advantage on this surface. These data are consistent with the initial hypotheses of the study.

On the other hand, the analysis of the finalists and winners of the U.S. Open reveals an opposite trend. The average height of the finalists has progressively decreased, from 177 cm in 2000 to 175 cm in 2024. However, from 2021 onwards, the range of variation between the minimum and maximum values has reduced, suggesting that in recent years a balance has been achieved between height and other physical qualities decisive for the game. This trend is only partially consistent with the initial assumptions. As for the winners, after a phase of fluctuating values until 2008, a stabilization is observed for almost a decade, coinciding with the dominance of one of the Williams sisters. From 2021 onwards, however, there is a new increase in the average height of the winners, confirming the expected general trend.

In the case of Roland Garros, the average height of the finalists shows a slight decrease, stabilizing at around 175 cm. This suggests that, on a surface such as clay, technical skills and endurance may have a greater weight than height. However, analyzing the winners, a different trend emerges: the average height has increased from 173 cm to 176.5 cm, with a stabilization starting from 2021 at a maximum value of 176 cm. This could indicate that although height is not the predominant factor on this surface, there is still a minimum threshold that is considered advantageous. This is in line with previous research showing that clay favors baseline play and physical endurance rather than the power and speed typical of hard surfaces (Reid et al., 2016).

The Wimbledon analysis, on the other hand, shows a decreasing trend in the average height of the finalists, which went from 183 cm to 177 cm in the period considered. This result, reinforced by the reduction of minimum and maximum absolute values, suggests that the characteristics required to excel on grass may differ from those of other surfaces. The same trend can be seen in the winners, with a decrease in average height and the presence of stationary periods. This trend, apparently at odds with initial assumptions, can be explained by considering the specificities of the herb, which reward speed, responsiveness and effective serve rather than tall stature (Liu et al., 2016).

Finally, the analysis of the Grand Slam winners in the period under consideration shows a general stability of the average height of around 176 cm, a value that coincides with the general trend. This suggests that while height is not constantly increasing in elite women's tennis, it is still a minimum requirement to compete at the highest level. However, starting from 2021, an increase in average height is observed, a figure that is at least partly consistent with the initial hypotheses of the study.

According to the authors of the study, the evolution of the average height of Grand Slam finalists and winners is the result of a natural selection process linked to the specific technical needs of each playing surface. The growth in stature in Australian Open and U.S. Open winners confirms the hypothesis that greater height can promote a more aggressive game, in line with previous studies highlighting the importance of height in serve and groundstrokes on hard surfaces (Giles & Reid, 2020). The stabilization of heights at Roland Garros suggests that other skills, such as mobility and endurance, may be more decisive for success on clay (Söğüt, 2018). For Wimbledon, the downward trend may indicate that quickness and the ability to adapt to an uneven surface are more important than stature (Vaverka & Cernosek, 2013). Overall, these results confirm what has emerged from the existing literature, in fact although height is a competitive advantage in tennis, its impact varies depending on the playing conditions and the strategies adopted by the athletes. Analyzing the data from the study allows significant conclusions to be drawn about the role of height in elite women's tennis, but it is important to consider both the strengths and limitations of the research.

This study has several strengths that strengthen its validity and scientific relevance. First, the analysis was conducted over a wide period of time, allowing us to identify evolutionary trends in the stature of the finalists and winners of Grand Slam tournaments. This longitudinal approach allows for a better understanding of the influence of height in elite women's tennis and to assess any adaptations due to changes in playing surfaces, playing style or athletic training patterns. In addition, the study uses objective and measurable data, ensuring a solid empirical basis for the conclusions drawn. Another strength is the integration with the existing literature, which allows the results to be contextualized and compared with previous research on the role of height in professional tennis.

However, the study also has some limitations. A first aspect to consider is that the analysis focuses exclusively on

height, without examining other anthropometric and biomechanical factors that could affect performance, such as limb length, muscle mass or body composition. In addition, the height of female athletes has been considered as an independent factor, while in reality success in tennis depends on a complex set of variables, including technical, tactical, psychological and athletic skills. Another limitation is individual variability: although the finalists and winners of Grand Slam tournaments have been analyzed, the sample may not be entirely representative of the entire population of professional tennis players. Finally, the study does not take into account possible future evolutions in the style of play or physical characteristics of female athletes, which could further change the relationship between height and success in tennis.

Despite these limitations, the study makes a significant contribution to understanding the role of height in elite women's tennis and paves the way for further research that could deepen the link between physical parameters and performance, including biomechanical and tactical aspects.

Conclusions

The study explored the evolution of the heights of Grand Slam finalists and winners, with the aim of understanding whether stature decisively influences success in elite women's tennis and how this impact can vary depending on the playing surface. Analysis of the data showed that height is indeed a relevant factor, but its role appears to be differentiated according to the specific characteristics of the tournament surfaces. The increase in average height in the Australian Open and U.S. Open finalists and winners, on fast surfaces, suggests that height can give advantages in terms of power and court coverage in these contexts. Conversely, data from Wimbledon and Roland Garros, with more stable or declining trends, suggest that on slower surfaces, such as grass and clay, other factors, such as mobility and endurance, may have a greater weight.

The stability observed in the average heights of Grand Slam tournament winners, with a slight increase since 2021, supports the hypothesis that there is an optimal minimum height to compete at world level, but also that the variability of physical characteristics remains a fundamental element in sporting success.

The practical implications of these results suggest that female athletes could be selected not only on the basis of their height, but also considering other physical and technical parameters, in particular those more related to the specificities of the surfaces on which they play. In addition, the findings contribute to a greater understanding of how women's tennis is evolving, with stature trends mirroring the game's adaptation to modern demands.

Despite the conclusions obtained, this study also raises questions about aspects that are still little explored. A future perspective could be to include additional anthropometric parameters, such as limb length or body composition, to better understand how these factors may interact with height to influence performance. In addition, it would be interesting to examine the evolution of the physical characteristics of female athletes in relation to athletic preparation and developments in tennis-specific training techniques.

Another line of research could focus on the analysis of the evolutionary trends in the stature of female athletes of different nationalities, to assess whether there are significant differences based on cultural or geographical factors. In addition, a deeper analysis of the interactions between physical characteristics and game tactics, such as the ability to adapt to different surfaces or the speed of the serve, could offer new insights for coaches and athletes in choosing training models.

Finally, longitudinal studies that also consider the future performance of female athletes could enrich the understanding of the evolution of physical characteristics over the course of a tennis player's career, thus offering further perspective on the impact of height and other physical parameters on success in elite women's tennis.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

Temesi, J., Szádoczki, Z., & Bozóki, S. (2024). Incomplete pairwise comparison matrices: Ranking top women tennis players. *Journal of the Operational Research Society, 75*(1), 145-157. https://doi.org/10.1080/01605682.2023.2180447

Scamardella, F., Casillo, V., & Cusano, P. (2020). Engagement and tennis: The applicability of occupational psychology to the world of sport. *Journal of Human Sport and Exercise, 2020, 15*(Proc2), 173-176. https://doi.org/10.14198/jhse.2020.15.proc2.07

Latino, F., Cataldi, S., Carvutto, R., De Candia, M., D'Elia, F., Patti, A., ... & Fischetti, F. (2021). The importance of lipidomic approach for mapping and exploring the molecular networks underlying physical exercise: A systematic review. *International Journal of Molecular Sciences, 22*(16), 8734. https://doi.org/10.3390/ijms22168734

Söğüt, M. (2018). Stature: Does it really make a difference in match-play outcomes among professional tennis players? *International Journal of Performance Analysis in Sport, 18*(2), 255-261. https://doi.org/10.1080/24748668.2018.1466259

Erlandson, M. C., Sherar, L. B., Mirwald, R. L., Maffulli, N., & Baxter-Jones, A. D. (2008). Growth and maturation of adolescent female gymnasts, swimmers, and tennis players. *Medicine & Science in Sports & Exercise, 40*(1), 34-42. https://doi.org/10.1249/mss.0b013e3181596678

Sanchez-Munoz, C., Sanz, D., & Zabala, M. (2007). Anthropometric characteristics, body composition and somatotype of elite junior tennis players. *British journal of sports medicine, 41*(11), 793-799. https://doi.org/10.1136/bjsm.2007.037119

Scamardella, F., Russo, N., & Napolitano, F. (2020). The phenomenon of load management. *J Physical Educ Sport,* 20, 2306-2309.

Pradas, F., de la Torre, A., Carrasco, L., Munoz, D., Courel-Ibanez, J., & Gonzalez-Jurado, J. A. (2021). Anthropometric profiles in table tennis players: Analysis of sex, age, and ranking. *Applied Sciences, 11*(2), 876. https://doi.org/10.3390/app11020876

Fett, J., Ulbricht, A., & Ferrauti, A. (2020). Impact of physical performance and anthropometric characteristics on

serve velocity in elite junior tennis players. *The Journal of Strength & Conditioning Research, 34*(1), 192-202. https://doi.org/10.1519/jsc.0000000000002641

Elce, A., Cardillo, G., Ventriglia, M., Giordano, C., Amirante, F., Mazza, G., ... & Martiniello, L. (2017). Anthropometric characteristics of young Italian tennis players. *Journal of Human Sport and Exercise, 12*(3), 651-658. https://doi.org/10.14198/jhse.2017.123.09

Baiget, E., Corbi, F., & López, J. (2023). Influence of anthropometric, ball impact and landing location parameters on serve velocity in elite tennis competition. *Biology of Sport, 40*(1), 273-281. https://doi.org/10.5114/biolsport.2023.112095

Kovalchik, S. (2018). The effect of player height on serve speed and dominance in men's professional tennis. *Journal of Quantitative Analysis in Sports, 14*(2), 69-81. https://doi.org/10.1515/jqas-2017-0086

Luna-Villouta, P., Paredes-Arias, M., Flores-Rivera, C., Hernández-Mosqueira, C., Souza de Carvalho, R., Faúndez-Casanova, C., ... & Vargas-Vitoria, R. (2021). Anthropometric characterization and physical performance by age and biological maturation in young tennis players. *International journal of environmental research and public health, 18*(20), 10893. https://doi.org/10.3390/ijerph182010893

Yasin, A., Omer, S., Ibrahim, Y., Akif, B. M., & Cengiz, A. (2010). Comparison of some anthropometric characteristics of elite badminton and tennis players. *Science, movement and health,* 2, 400-405.

Sánchez-Pay, A., Ramón-Llin, J., Martínez-Gallego, R., Sanz-Rivas, D., Sánchez-Alcaraz, B. J., & Frutos, S. (2021). Fitness testing in tennis: Influence of anthropometric characteristics, physical performance, and functional test on serve velocity in professional players. *PloS one, 16*(11), e0259497. https://doi.org/10.1371/journal.pone.0259497

Söğüt, M. (2019). Height-and surface-related variations in match-play outcomes and rankings in professional men's tennis. *German Journal of Exercise and Sport Research, 49*(3), 332-338. https://doi.org/10.1007/s12662-019-00612-2

Santisteban, D., et al. (2024). Anthropometric Profile And Maximum Serve Speed In Male Tennis Players From A Peruvian Sports Medical Center. *Revista de la Facultad de Medicina Humana, 24*(3), 78-84. https://doi.org/10.25176/rfmh.v24i3.6677

Parpa, K., Michaelides, M., Petrov, D., Kyrillou, C., & Paludo, A. C. (2022). Relationship between physical performance, anthropometric measurements and stroke velocity in youth tennis players. *Sports, 11*(1), 7. https://doi.org/10.3390/sports11010007

Chapelle, L., Pion, J., Clarys, P., Rommers, N., & D'Hondt, E. (2023). Anthropometric and physical performance determinants of young tennis players progressing through a talent identification and development programme. *International Journal of Sports Science & Coaching, 18*(5), 1469-1477. https://doi.org/10.1177/17479541221115855

Olcucu, B., & Vatansever, S. (2015). Correlation between physical fitness and international tennis number (ITN) levels among children tennis players. T*he Anthropologist, 21*(1-2), 137-142. https://doi.org/10.1080/09720073.2015.11891803

Reid, M., Quinn, A., & Crespo, M. (2010). Strength and conditioning in tennis: Current research and practice. *Journal of Science and Medicine in Sport, 13*(1), 3-9. https://doi.org/10.1016/j.jsams.2009.05.002

Liu, H., Yi, Q., Giménez, J., Gómez, M. A., & Lago-Peñas, C. (2016). Performance profiles of male and female professional tennis players in Grand Slams. *PLoS ONE, 11*(10), e0166381.

Giles, B., Kovalchik, S., & Reid, M. (2020). A machine learning approach for automatic detection and classification of changes of direction from player tracking data in professional tennis. *Journal of sports sciences, 38*(1), 106-113. https://doi.org/10.1080/02640414.2019.1684132

Vaverka, F., Cernosek, M. (2013). Association between body height and serve speed in elite tennis players. *Sports Biomechanics, 12*(1), pp. 30-37. https://doi.org/10.1080/14763141.2012.670664

Антропометричні аспекти та спортивна результативність у жіночому тенісі

Фабіо Скамарделла[1ABCDE], Франческо Тафурі[2ABCDE], Джулія Амато[1ABCDE], Франческа Латіно[3ABCDE], Марія Джованна Тафурі[3ABCDE]

[1]Неаполітанський університет «Парфенопа»
[2]Університет Нікколо Кузано
[3]Університет Пегаса

Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 9 с., 1 табл., 9 рис., 24 джерел.

Історія питання. В останні десятиліття питання еволюції фізичних характеристик спортсменок у жіночому тенісі стало предметом зацікавленості, особливо щодо впливу зросту на досягнення успішних результатів на турнірах Великого шлему.

Мета дослідження. Це дослідження мало на меті проаналізувати еволюцію показників зросту фіналісток і переможниць жіночих турнірів Великого шлему задля визначення того, чи є зріст вирішальним фактором успіху і чи варіюється цей вплив залежно від типів покриття ігрового майданчика.

Матеріали та методи. Проведено ретроспективний аналіз показників зросту фіналісток та переможниць з 2000 по 2024 рік на чотирьох головних турнірах Великого шлему: Відкритий чемпіонат Австралії, Ролан-Гаррос, Вімблдон і Відкритий чемпіонат США. Порівняння даних проводилось між турнірами на швидких покриттях (Відкритий чемпіонат Австралії та Відкритий чемпіонат США) та турнірами на повільних покриттях (Ролан-Гаррос та Вімблдон).

Результати. Результати дослідження встановили значне підвищення показників середнього зросту фіналісток та переможниць турнірів на швидких покриттях, причому чітке збільшення цього показника спостерігається з 2021 року. У турнірах на повільних покриттях показник середнього зросту мав стабільніші тенденції або дещо знижувався, що свідчить про ключову роль у досягненні успішних результатів інших фізичних якостей, таких як рухливість і витривалість. Зокрема, показник середнього зросту фіналісток Відкритого чемпіонату Австралії та Відкритого чемпіонату США демонстрував постійне зростання, тоді як на турнірах Ролан-Гаррос та Вімблдоні коливання показників виявилися стриманішими.

Висновки. Проведене дослідження підтверджує, що зріст має суттєвий вплив на досягнення успішних результатів у турнірах Великого шлему, однак цей вплив опосередковується типом покриття ігрового майданчика. У турнірах на швидких покриттях вищий зріст, ймовірно, надає конкурентну перевагу, в той час як на повільних покриттях свою роль можуть відігравати інші фізичні фактори. Подальші перспективи включають вивчення інших антропометричних змінних та аналіз їхньої еволюції відповідно до потреб сучасної гри.

Ключові слова: антропометричні аспекти, результативність, жіночий теніс.

Information about the authors:

Scamardella, Fabio: fabio.scamardella@uniparthenope.it; https://orcid.org/0000-0001-7970-2539; University of Napoli Parthenope, Via Ammiraglio Ferdinando Acton, 38, 80133 Napoli NA, Italy.

Tafuri, Francesco: francesco.tafuri@unicusano.it; https://orcid.org/0000-0003-4059-3122; Niccolò Cusano University, Via Don Carlo Gnocchi, 3, 00166 Roma RM, Italy.

Amato, Giulia: giulia.amato@uniparthenope.it; https://orcid.org/0009-0004-4383-175X; University of Napoli Parthenope, Via Ammiraglio Ferdinando Acton, 38, 80133 Napoli NA, Italy.

Latino, Francesca: francesca.latino@unipegaso.it; https://orcid.org/0000-0003-0302-6145; Pegaso University, Centro Direzionale Isola F2, 80143 Napoli NA, Italy.

Tafuri, Maria Giovanna: mariagiovannatafuri@unipegaso.it; https://orcid.org/0009-0008-5835-1846; Pegaso University, Centro Direzionale Isola F2, 80143 Napoli NA, Italy.

Cite this article as: Scamardella, F., Tafuri, F., Amato, G., Latino, F., & Tafuri, M. G. (2025). Anthropometric Aspects and Athletic Performance in Women's Tennis. *Physical Education Theory and Methodology, 25*(3), 566-574. https://doi.org/10.17309/tmfv.2025.3.12

Received: 03.04.2025. Accepted: 28.04.2025. Published: 30.05.2025