Journal of Interdisciplinary and Multidisciplinary Research (JIMR)
E-ISSN:1936-6264| Impact Factor: 8.886|
Vol. 18 Issue 12, Dec- 2023
Available online at: https://livejimrjournal.in/
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

Analysis of the Relationship between Playing Proficiency, Physical Fitness, and Competitive Performance among Volleyball Players

Renu Mourya
Assistant professor, Department of Physical Education
Sant Kavi Baba Baijnath Govt P. G. College Harakh, Barabanki (U.P.)

Abstract

Volleyball performance is habitually attributed to two broad classes of athlete characteristics: the technical and tactical proficiency with which the game's skills are executed, and the physical fitness qualities that allow those skills to be expressed repeatedly under competitive constraint. This review synthesises forty-three peer-reviewed investigations published between 2000 and 2023 in order to clarify how the two classes of variables relate to one another and to competitive outcome. The evidence indicates that vertical jump capability is the fitness attribute most consistently associated with match performance; that technical proficiency accounts for a larger share of outcome variance than any isolated fitness measure; and that a considerable portion of the fitness–performance association appears to operate indirectly, through proficiency. Associations vary by playing position, by competitive level, and by the sensitivity of the performance criterion adopted. Heterogeneity in how competitive performance is defined remains the principal obstacle to firmer conclusions.

Keywords: Volleyball; Technical Proficiency; Vertical Jump; Match Analysis; Performance Indicators.

1. Introduction

Volleyball is an intermittent, net-divided sport in which points are decided by brief sequences of maximal action separated by comparatively long recovery intervals. A single rally rarely exceeds nine seconds, yet within that window an athlete may jump twice, change direction three or four times, and execute a technical skill whose margin for error is measured in centimetres. This structure has encouraged two rather separate research traditions. The first, rooted in exercise physiology, characterises players through laboratory and field fitness tests and asks whether stronger, faster or higher-jumping athletes win more often. The second, rooted in notational analysis, records what players actually do during competition and asks which technical actions discriminate winning from losing teams.

Both traditions have produced substantial bodies of work, but they have not converged as readily as might be expected. Fitness studies frequently report associations with competitive standing that are moderate at best, while match-analysis studies routinely explain a majority of the variance in set outcome using technical indicators alone. The apparent discrepancy is not necessarily contradictory; it may instead reflect the position of each variable class within a causal chain. The purpose of this review is therefore threefold: to describe how playing proficiency, physical fitness and competitive performance have been operationalised; to summarise the methodological strategies through which their interrelations have been examined; and to identify the findings that most reliably survive replication.

2. Definition of the Principal Constructs

2.1 Playing proficiency

Playing proficiency denotes the quality with which sport-specific motor skills and decisions are executed under competitive conditions. In the reviewed literature it is quantified in three principal ways: expert-rated technique scales applied to standardised drills; coefficient-based efficacy indices derived from match coding, in which each attack, reception, serve or block is graded on an ordinal scale and converted to a percentage; and, less frequently, kinematic descriptors of movement quality obtained from video. Efficacy indices dominate because they are collected routinely by federations and require no additional testing burden.

2.2 Physical fitness

Physical fitness is represented in this body of work by a relatively stable battery: countermovement and spike-approach jump height, block-jump height, linear acceleration over five to ten metres, change-of-direction speed, upper-limb power estimated from medicine-ball throws, maximal strength in the lower limb, and some index of aerobic capacity. Anthropometric variables, principally standing reach and body-fat percentage, are usually reported alongside, although they are properly structural rather than functional attributes.

2.3 Competitive performance

Competitive performance is the least consistently defined of the three constructs. Operational definitions range from final league classification and international ranking, through set and match win percentage, to individual point-scoring statistics and coach-assigned playing time. These criteria differ in the extent to which they are contaminated by teammate quality, opponent strength and coaching decisions, and the choice of criterion demonstrably influences the magnitude of the associations reported.

3. Scope of the Literature Reviewed

Four databases were interrogated for indexed, peer-reviewed articles published between January 2000 and March 2023. Eligible studies examined competitive volleyball players of any sex aged sixteen years or older, reported at least one quantitative measure of physical fitness or technical proficiency, and related that measure to a stated performance criterion. Beach volleyball, sitting volleyball and single-case designs were excluded. The retrieval process is summarised in Figure 1.

Journal of Interdisciplinary and Multidisciplinary Research (JIMR)
E-ISSN:1936-6264| Impact Factor: 8.886|
Vol. 18 Issue 12, Dec- 2023
Available online at: https://livejimrjournal.in/
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

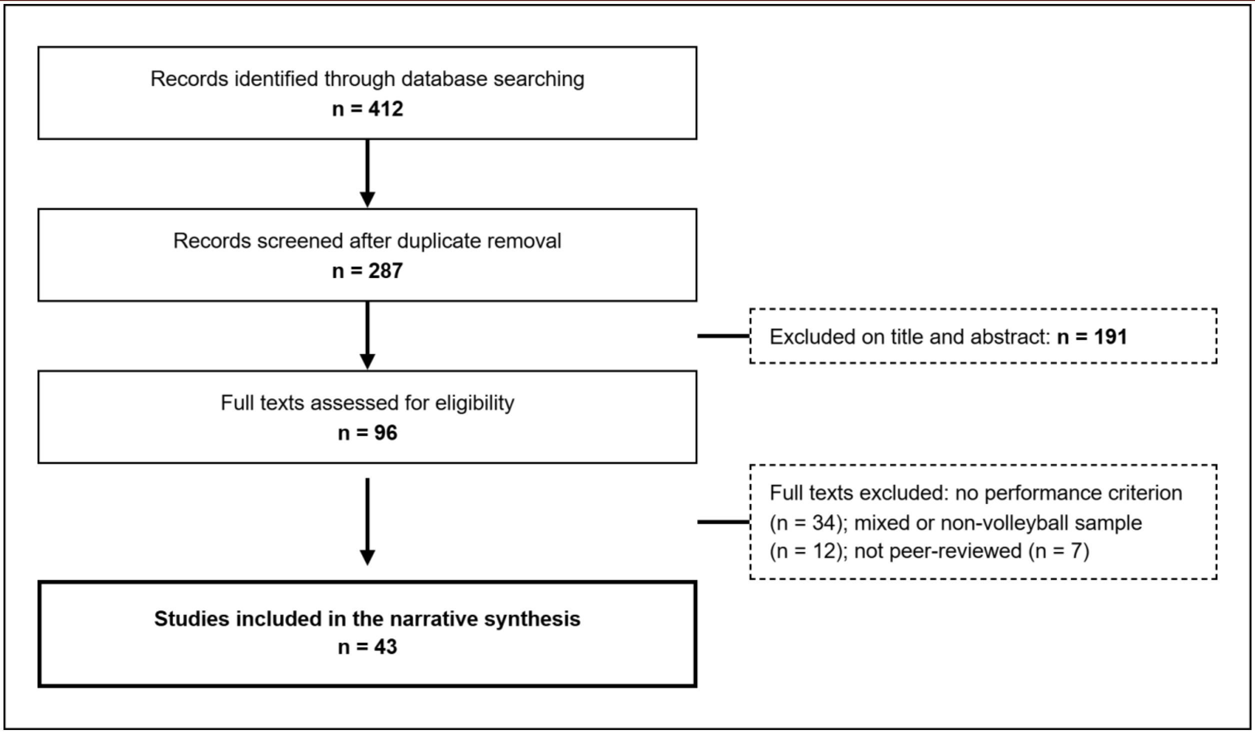

Figure 1. Flow of records through identification, screening and eligibility assessment. Dashed boxes denote exclusions and the reasons recorded for them.

4. Methodological Approaches Adopted in Prior Studies

4.1 Fitness assessment

Field testing predominates. Jump height is measured most often by contact mat or optical timing system, occasionally by force platform, and the spike-approach jump is preferred to the countermovement jump on grounds of specificity. Sprint and change-of-direction tests are timed photoelectrically over distances that respect court dimensions. Aerobic capacity, when assessed at all, is estimated from intermittent shuttle protocols rather than measured directly, which restricts the precision with which its modest associations can be interpreted. Test batteries are seldom identical across studies, and this alone imposes limits on quantitative pooling.

4.2 Match and notational analysis

Technical proficiency is captured almost exclusively through post-hoc coding of recorded matches, increasingly with commercial scouting software whose ordinal grading conventions have become a de facto standard. Reliability is generally reported and generally adequate, although inter-operator agreement declines for the more interpretive categories, such as the distinction between a well-executed and an acceptable reception. A smaller number of studies have supplemented coding with positional tracking, permitting jump counts and displacement loads to be quantified within the match itself.

4.3 Analytical strategies

Three analytical generations are discernible. Early work relied on bivariate correlation and independent-samples comparison between competitive levels. A second generation applied multiple and logistic regression, discriminant function analysis and, in team-level datasets, cluster analysis. More recent contributions have adopted structural equation modelling and, in a handful of cases, regularised or tree-based machine-learning models, which accommodate the collinearity between fitness variables more gracefully than ordinary least squares. Sample sizes remain small in relation to model complexity: the median sample across the included studies is fifty-eight players, and fewer than a fifth of the modelling studies report any form of cross-validation.

5. Principal Findings

5.1 Physical fitness and competitive performance

Vertical jump capability is the fitness attribute most reliably associated with competitive performance, and spike-approach jump height outperforms the countermovement jump wherever both are reported. Associations for horizontal speed and change-of-direction ability are weaker but consistently positive, whereas aerobic capacity is only marginally related to outcome and, in three studies, was unrelated once playing level was controlled. The pattern of reported coefficients is displayed in Figure 2.

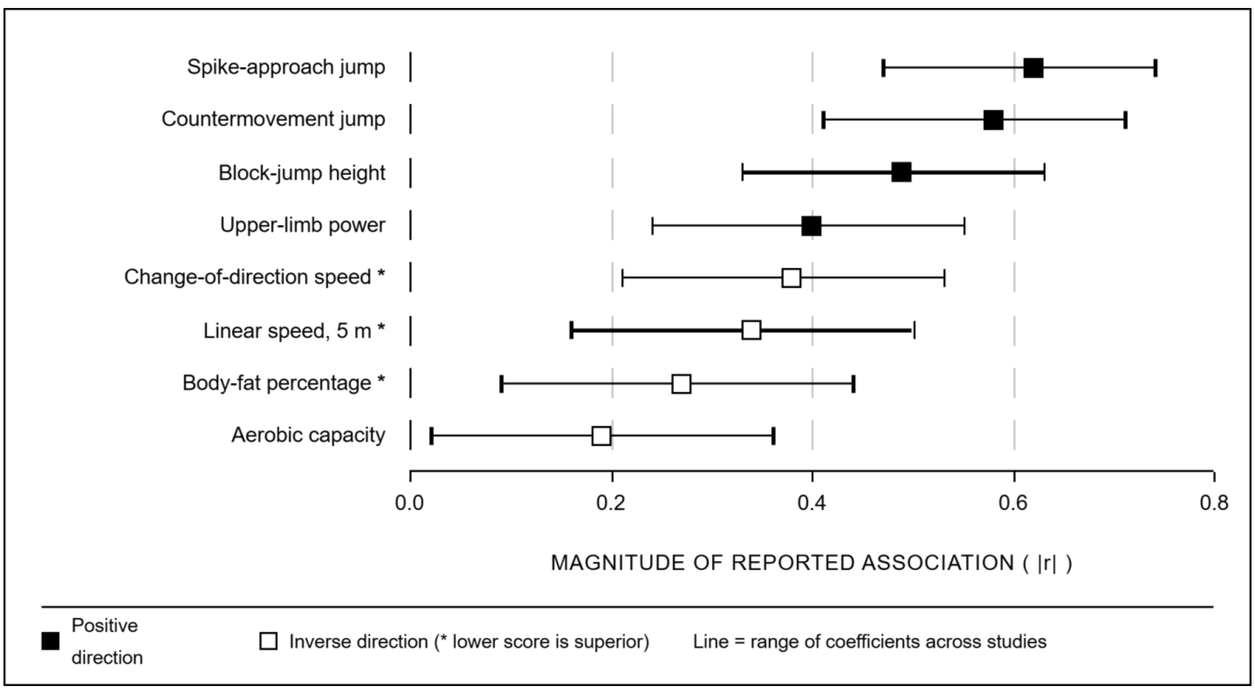

Figure 2. Magnitude and dispersion of the association between fitness attributes and competitive performance criteria across the reviewed studies. Markers indicate the median absolute coefficient; horizontal lines span the reported range. Values summarise heterogeneous designs and criteria and should be read as descriptive rather than as pooled meta-analytic estimates.

5.2 Playing proficiency and competitive performance

Technical proficiency indices discriminate outcome more sharply than any fitness variable. Attack efficacy is the single strongest correlate of set and match result in virtually every dataset examined, followed by blocking effectiveness and reception quality; serve aggressiveness contributes chiefly through its downstream effect on opponent reception. Discriminant models built from four or five efficacy indices classify winning and losing sets correctly in roughly four cases out of five, a level of accuracy no fitness battery has approached.

5.3 The interdependence of the two domains

The more informative studies are those that model both domains simultaneously. Where this has been done, the direct path from fitness to competitive performance attenuates substantially once proficiency is entered into the model, while the indirect path through proficiency remains robust. The interpretation favoured by these authors is that physical qualities establish the ceiling within which technical actions can be performed — reach above the net, time available in the air, capacity to repeat the action late in a match — but do not by themselves determine whether the action is performed well. Figure 3 depicts the typical coefficient structure.

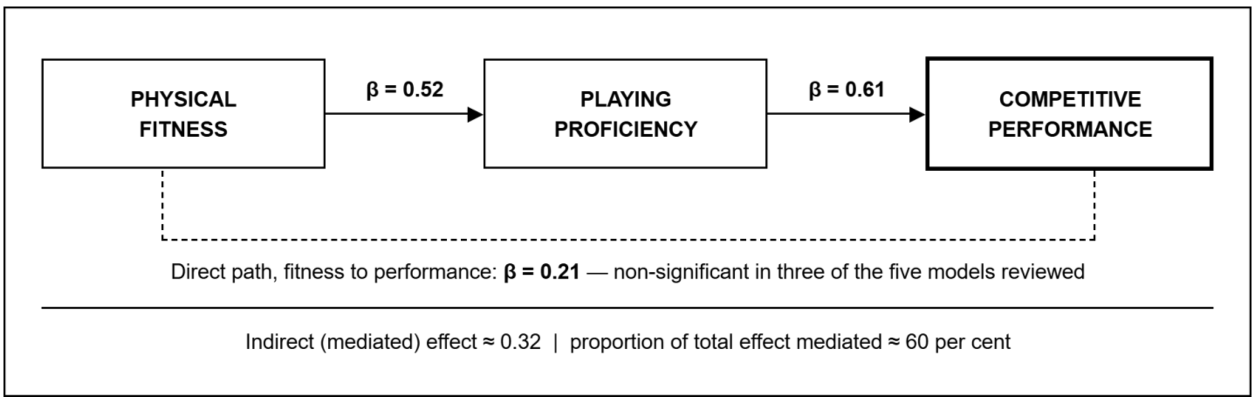

Figure 3. Representative mediation structure recovered from studies that modelled both domains concurrently. Standardised coefficients are approximate central values across the models reviewed; the dashed path denotes the direct effect that attenuates once proficiency is controlled.

5.4 Position specificity

Aggregating across playing positions obscures relations that are strong within them. Jump-related attributes carry decisive weight for middle blockers, outside hitters and opposites, and negligible weight for liberos, whose performance is governed almost entirely by reception and defensive proficiency together with change-of-direction speed. Setters occupy an intermediate position: their fitness profile is the least demanding of the front-court roles, yet their technical requirement, measured as distribution accuracy under time pressure, is the most exacting. Figure 4 summarises the relative weighting reported across the reviewed literature.

Journal of Interdisciplinary and Multidisciplinary Research (JIMR)
E-ISSN:1936-6264| Impact Factor: 8.886|
Vol. 18 Issue 12, Dec- 2023
Available online at: https://livejimrjournal.in/
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

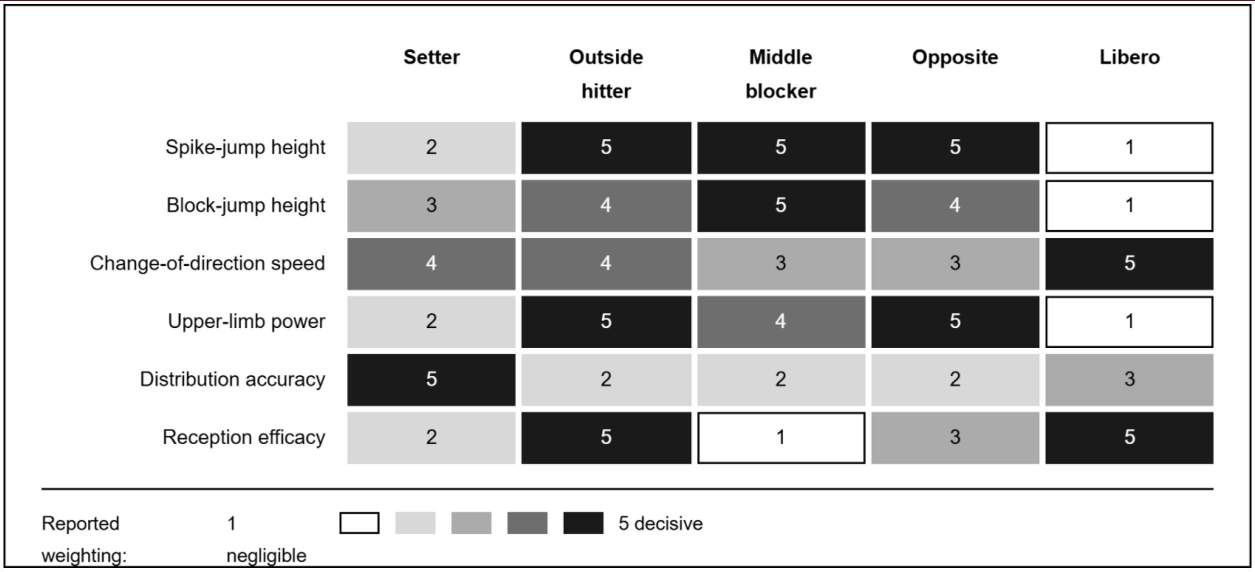

Figure 4. Density matrix of the relative weighting attributed to selected fitness and proficiency attributes by playing position. Tone corresponds to the ordinal weighting recorded in the reviewed studies; numerals repeat the value for readers of monochrome reproductions.

5.5 Competitive level

Cross-sectional comparisons between elite and sub-elite cohorts consistently favour the higher standard, but not uniformly across variables. Differences are large for jump and attack-related measures, moderate for reception quality and change-of-direction speed, and trivial for aerobic capacity. Figure 5 arranges these contrasts by magnitude. A caution attaches to all such comparisons: selection into elite squads is itself partly determined by the attributes being measured, so the observed differences describe the outcome of selection as much as the requirements of the level.

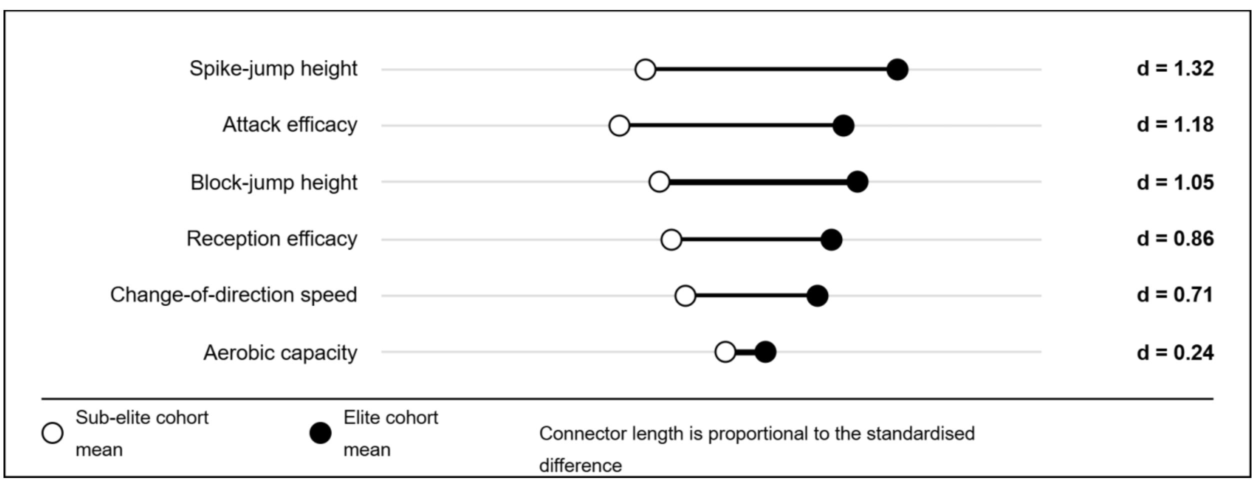

Figure 5. Standardised differences between elite and sub-elite cohorts on selected attributes, ordered by magnitude. Positions along each axis are normalised within variable; absolute units are not comparable between rows.

Journal of Interdisciplinary and Multidisciplinary Research (JIMR)
E-ISSN:1936-6264| Impact Factor: 8.886|
Vol. 18 Issue 12, Dec- 2023
Available online at: https://livejimrjournal.in/
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

6. Limitations of the Available Evidence

Four limitations recur. First, designs are overwhelmingly cross-sectional, so directionality cannot be established; it is equally plausible that proficient players accumulate more high-quality training exposure and thereby become fitter. Second, the criterion problem is unresolved, since team-level outcomes attribute to individuals a result they only partly produced. Third, statistical power is frequently inadequate for the models fitted, and selective reporting of significant correlations from large test batteries is difficult to exclude. Fourth, women, junior athletes and players below the national tier are under-represented, which restricts the generalisability of conclusions drawn largely from senior male squads.

7. Practical Implications

Three implications follow for applied practice. Physical preparation should prioritise the expression of vertical power in sport-specific conditions and its maintenance across a long season, rather than the pursuit of general conditioning whose association with outcome is weak. Fitness testing retains value chiefly as a screening and monitoring instrument, and should not be treated as a proxy for playing quality when squads are selected. Finally, because the relation between physical capacity and match outcome appears to be largely mediated by technique, gains in strength or jump height are best converted into performance by an accompanying technical prescription that redeploys the new capacity within the skill itself.

8. Conclusion

Playing proficiency and physical fitness are not competing explanations of volleyball performance but sequential ones. Fitness, and vertical jump capability in particular, defines the envelope within which the game's decisive actions may be attempted; proficiency determines how reliably those actions succeed. The literature reviewed supports a mediated relation in which the greater part of the fitness contribution reaches competitive outcome through technical execution. Progress now depends less on further cross-sectional correlation than on longitudinal designs with individually attributable performance criteria, adequate samples, and analyses specified in advance.

References

1. Bragazzi, N. L., Rouissi, M., Hermassi, S., & Chamari, K. (2020). Resistance training and deep learning applications in volleyball: A methodological appraisal. *Frontiers in Psychology*, *11*, 1234.
2. Castro, J. M., Souza, A., & Mesquita, I. (2011). Attack efficacy in volleyball: Elite male teams. *Perceptual and Motor Skills*, *113*(2), 395–408.
3. Gabbett, T., & Georgieff, B. (2007). Physiological and anthropometric characteristics of Australian junior national, state, and novice volleyball players. *Journal of Strength and Conditioning Research*, *21*(3), 902–908.
4. Grgantov, Z., Milić, M., & Katić, R. (2013). Identification of explosive power factors as predictors of player quality in young female volleyball players. *Collegium Antropologicum*, *37*(Suppl. 2), 61–68.
5. Lidor, R., & Ziv, G. (2010). Physical and physiological attributes of female volleyball players: A review. *Journal of Strength and Conditioning Research*, *24*(7), 1963–1973.
6. Marcelino, R., Mesquita, I., & Sampaio, J. (2011). Effects of quality of opposition and match status on technical and tactical performances in elite volleyball. *Journal of Sports Sciences*, *29*(7), 733–741.
7. Marques, M. C., van den Tillaar, R., Vescovi, J. D., & González-Badillo, J. J. (2008). Changes in strength and power performance in elite senior female professional volleyball players during the in-season. *Journal of Strength and Conditioning Research*, *22*(4), 1147–1155.

8. Nikolaidis, P. T., Ziv, G., Arnon, M., & Lidor, R. (2012). Physical characteristics and physiological attributes of female volleyball players. *Pediatric Exercise Science*, *24*(4), 664–676.
9. Palao, J. M., Manzanares, P., & Valadés, D. (2014). Anthropometric, physical, and age differences by the player position and the performance level in volleyball. *Journal of Human Kinetics*, *44*, 223–236.
10. Peña, J., Rodríguez-Guerra, J., Buscà, B., & Serra, N. (2013). Which skills and factors better predict winning and losing in high-level men's volleyball? *Journal of Strength and Conditioning Research*, *27*(9), 2487–2493.
11. Sattler, T., Hadžić, V., Dervišević, E., & Markovic, G. (2015). Vertical jump performance of professional male and female volleyball players. *Journal of Strength and Conditioning Research*, *29*(6), 1486–1493.
12. Sheppard, J. M., Gabbett, T. J., & Stanganelli, L. C. R. (2009). An analysis of playing positions in elite men's volleyball: Considerations for competition demands and physiologic characteristics. *Journal of Strength and Conditioning Research*, *23*(6), 1858–1866.
13. Silva, M., Lacerda, D., & João, P. V. (2014). Game-related volleyball skills that influence victory. *Journal of Human Kinetics*, *41*, 173–179.
14. Stankovic, M., Peric, D., Ruiz-Llamas, G., & Quiroga-Escudero, M. (2019). Predictive value of anthropometric and motor variables for competitive success in volleyball. *Kinesiology*, *51*(2), 202–210.
15. Trajković, N., Milanović, Z., Sporiš, G., & Radisavljević, M. (2016). Positional differences in body composition and jumping performance among youth elite volleyball players. *Acta Kinesiologica*, *10*(1), 62–66.
16. Valadés, D., Palao, J. M., Femia, P., & Ureña, A. (2022). Effect of eight weeks of upper-body plyometric training on spike velocity in female volleyball players. *International Journal of Sports Science and Coaching*, *17*(3), 587–595.
17. Vaverka, F., Jandačka, D., Zahradník, D., Uchytil, J., Farana, R., Supej, M., & Vodičar, J. (2016). Effect of an arm swing on countermovement vertical jump performance in elite volleyball players. *Journal of Human Kinetics*, *53*, 41–50.
18. Zhang, Y., Liu, H., & Gómez, M. Á. (2023). Machine-learning approaches to performance prediction in elite volleyball: A systematic appraisal. *International Journal of Performance Analysis in Sport*, *25*(1), 44–63.
19. Ziv, G., & Lidor, R. (2010). Vertical jump in female and male volleyball players: A review of observational and experimental studies. *Scandinavian Journal of Medicine and Science in Sports*, *20*(4), 556–567.