



Review Article

The Influence of Performance Factors in Team Sports and Methodological Indications in Relation to the Performance Model: A Systematic Review

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Abstract

Objectives. The issue lies in whether or not there are common performance factors across different team sports. The objective of this review was to identify and analyze the key elements influencing physical performance in various team sports, which can be enhanced through training, respecting the performance model of each team sport.

Materials and methods. For the selection of articles, the Prisma method, Pubmed and Google Scholar search engines were used, and inclusion criteria were established. After conducting the initial search, a total of 596 articles were identified. These articles were then further screened through several stages to select 20 final articles that aligned with the theme.

Results. This review has highlighted important determinants of sports performance in common and uncommon among the different team sports analyzed and how they can be improved through training practices, taking into consideration the performance pattern of each team sport.

Conclusions. Achieving success in sport and the training of excellent players is increasingly dependent on the specificity of the coaching stimulus provided and how much it responds to the performance model of the team sport's type, and the competence of the coaching staff.

Keywords: performance analysis, conditional quality, performance model, practical applications.

Introduction

This review will analyse the performance factors, with a focus on what limits or enhances sports performance, and what practical indications can be used to improve that performance. In most team sports, sports performance requires more technical and tactical skills; while successful teams must also possess relevant physical skills (Bangsbo, 2015). The team sports examined, such as basketball, soccer, handball, rugby, and volleyball, require various physical skills and specific technical skills that are highly coordinative in order to achieve sporting success, as well as having to make quick decisions, during a competition, to solve complex technical and tactical motor tasks (Serpell et al., 2011). In team sports, there are factors such as reaction speed, acceleration, top speed, speed in whole-body changes of direction (Simonek et al., 2017) and agility that determine

a high value of sports performance (Little & Williams, 2005). However, there are slight differences in agility among players in team sports, this is probably due to demands on the quality of open skill movements (Belka et al., 2022). Running, in sports games, is characterized by continuous phases of acceleration and deceleration (Altavilla, 2020); in fact, players are required to repeatedly produce maximal or sub-maximal efforts with short recoveries (Bishop & Girard, 2013). Determinants in team sports are therefore the ability to accelerate and decelerate, change direction, jump, and repeat a series of actions at different speeds without reducing the quality of performance, and this is basic to sporting success (Jones et al., 2009). In fact, in soccer, accelerations and decelerations are found to be significant (Altavilla et al, 2017); in basketball and handball, changes of direction and jumps (Abdelkrim et al, 2007); in volleyball, jumps, landings, and explosive force (Tsoukos et al, 2019, D'Elia et al, 2021), while contrasts, thrusts, and tackles are found to be determinant mainly in rugby (Jones et al, 2015). As established in the literature, intense accelerations and decelerations (Delves

et al, 2021; Dalen et al, 2016) constitute a substantial part of the external workload and impose physiological and mechanical internal load demands on players (Burdon et al, 2017). However, accelerations have a higher metabolic cost (Hader et al., 2016), while decelerations have a higher mechanical load, probably caused by high force impact peaks (Verheul et al., 2019). Increasingly, systems capable of collecting data to assess the physical and technical-tactical performance of individual players and teams (Hoppe et al., 2018) are represented by Global Positioning System (GPS) and Match analysis (MA) for the detection of these variables and subsequent assessments. GPS and MA have assumed a very important role in sports games (Carling et al., 2009; McGarry et al., 2013); in fact, they are the most widely used devices for quantifying the quality, quantity of actions expressed, and characteristics of high-intensity accelerations and decelerations during matches (O'Donoghue, 2015).

The purpose of this review is to bring out and analyze common and non-common determinant aspects of physical performance among the team sports considered; which can be improved with specific training practices, within the performance model of each team sport.

Materials and Methods

The study was conducted through a review of the scientific literature aimed at identifying determinants capable of influencing performance in team sports. The PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) method was used, for which inclusion criteria were defined (Table 1). Scientific articles were searched through the following search engines: Pubmed and Google Scholar. The following keywords were searched: Performance analysis, conditional quality, team sport. Inclusiveness criteria were defined for article selection: year of publication, reviews and experimental studies, longitudinal studies, English language.

Table 1. Inclusion criteria

Web search engines	Pubmed and Google Scholar
Publishing period	2014-2023
keywords	Performance analysis, conditional quality, team sport.
Language	English
Type of article	Original research articles and/or review articles
Full text	Articles matched the purpose and/or topic of the research.

Results

After conducting the initial search, a total of 596 articles were identified. These articles were then further screened through several stages to select 20 final articles that aligned with the theme. Specifically, 13 reviews, 6 experimental studies and 1 longitudinal study were included. Table 2 shows, for each study, the authors, topic, method used, and results.

Discussion

To optimize the training process, it is essential to know what happens during a competition (Taylor et al, 2017).

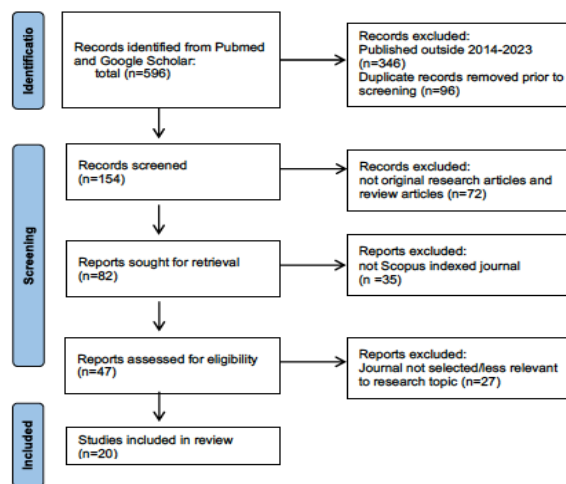


Fig. 1. PRISMA flowchart illustrating the item selection process

In order to gain such knowledge, it is necessary to analyze performance in team sports (Pino-Ortega et al, 2021), which analysis involves the study of different variables (technical, tactical, conditional), evaluation of training and competition workloads. Such a study provides quantitative knowledge about the level and technical, tactical, and behavioral characteristics of players in different team sports, such as in soccer, basketball, rugby, handball, and volleyball (Bangsbo et al., 2006; Svilar et al., 2018; Parmar et al., 2018; García-Sánchez et al., 2023; Silva et al., 2016).

Methodological Directions

Each team sport has its own performance model, where there is a certain level of strength, speed and endurance; therefore, training for each type of sport should reflect these differences. The most effective training methodology is one that approaches the functional model of competition (Cook, 2011). In order to implement an approach that is closest to the functional model of competition, it is essential to know what happens during the match; this allows the training process to be optimized. The continuous monitoring of sports performance (Esposito & Raiola, 2020) leads to the structuring of a performance model that meets the demands of a given team sport. We can define the performance model as a general framework of the specific characteristics of a sport: match times, energy metabolisms and type of movements.

Determining Factors

When a team or any athlete is training, it is necessary to know the performance pattern of his or her sport activity, from the perspective of internal load (e.g., heart rate, VO_2 max, etc.) and external load (e.g., distance traveled, accelerations, decelerations, etc.); therefore, close monitoring of these specific actions during training and competition is appropriate for effective workload management (Impellizzeri et al., 2019). Tools such as devices, specific motor tests, and match analysis are essential for monitoring performance and optimizing workloads. Without neglecting other aspects of performance such as,

Table 2. Results of the literature review

N.	Authors	Topics	Method	Results
1	Pino-Ortega et al., 2021	Conditional quality and team sports	Systematic review	Design training tasks: Soccer, high level of aerobic endurance in combination with very intense and short actions. Basketball, high level of aerobic endurance with a high number of jumps and landings. Rugby, high speed of pace of play with intense efforts and collisions.
2	Taylor et al., 2017	Performance analysis and team sports	Systematic review	There is considerable variability in straight-line running and multidirectional demands among sports, competition levels, and sexes. Variability in sports demand data was found among sports, sexes, and age levels..
3	Impellizzeri et al., 2019	Performance analysis and team sports	Longitudinal study	When internal and external loads are implemented effectively, they can help coaches better control and optimize the training process.
4	Harper et al., 2019	Conditional quality and team sports	Systematic review and Meta-Analysis	19 studies, including seven team sports with a total of 469 participants (males with an average age of 18-29 years). High-intensity accelerations and decelerations are important elements of external biomechanical loading in team sports. In all team sports, apart from American Football, there was a higher frequency of high and very high intensity decelerations than accelerations. To ensure that elite players are optimally prepared for the high-intensity accelerations and decelerations required during games, it is essential that players are exposed to comparable demands under controlled training conditions.
5	Suchomel et al., 2016	Conditional quality and team sports	Literature review	Much research supports the idea that greater muscle strength can improve the ability to perform sports skills such as jumping, sprinting, and change-of-direction tasks. Muscle strength is strongly correlated with superior jumping, sprinting, and change of direction performance. Therefore, sports professionals should implement long-term training strategies that promote maximum muscle strength.
6	Hernández et al., 2021	Performance analysis and team sports	Experimental study	Results confirm the high reliability of the hexagon agility test. In addition, the performance was significantly related to the performance obtained in different physical performance measurements (change of direction, jump, and linear sprint tests).
7	Sattler et al., 2015	Conditional quality and team sports	Experimental study	The results underscore the importance of vertical jumps in many sports, including volleyball. From a practical point of view, the results suggest that professional male and female volleyball players perform better in vertical jumping, thus underscoring the importance of lower limb strength development and power qualities in volleyball players.
8	Spiteri et al., 2019	Conditional quality and team sports	Experimental study	The results provide evidence of the importance of lower extremity power, change of direction and agility in female basketball athletes to compete at high levels of play. Prescribing squats, power cleans or plyometric exercises and emphasizing the eccentric phase of the movement will develop in players the ability to tolerate a greater eccentric load by helping them decelerate and improving COD.
9	Silva et al., 2018	Performance analysis and team sports	Systematic review and Meta-analysis.	The review shows that a 72-hour post-match period is not sufficient to fully restore homeostatic balance (muscle damage, physical status, and well-being). Coaches must adjust the structure and content of training sessions during the 72-hour post-match intervention period to effectively manage the training load.
10	Gottlieb et al., 2021	Conditional quality and team sports	Literature review	For consistent, high-level performance throughout the season, conditioning is key. Aerobic capacity is significant in basketball for rapid recovery from repeated sprints and jumps. Therefore, coaches and athletic trainers must properly measure their players' aerobic capacity.

Table 2 (continued)

N.	Authors	Topics	Method	Results
11	Halouani et al., 2014	Performance analysis and team sports	A Brief Review	Small-sided games are widely used by coaches to develop technical and tactical skills and to improve the endurance of team sports players. In fact, higher exercise intensity is achieved with fewer players and larger field areas. Using different durations of practice seems to have minimal effect on exercise intensity. Regarding duration, the use of SSG 4×4 minutes seems to offer the most effective format.
12	Petway et al., 2020	Performance analysis and team sports	Systematic review	From the results of the present review, it appears that higher level players seem to be more efficient while moving around the field. Elite level players cover fewer distances, at lower average speeds and with lower HRmax and HRave during competition. However, they appear to have greater ability to move at higher speeds.
13	Ortega-Bacerra et al., 2018	Conditional quality and team sports	Experimental study	The results indicate that handball throwing speed is strongly associated with lower limb strength, although upper limb strength, jumping and sprinting skills also play a relevant role in throwing performance, suggesting the need for coaches to include appropriate strength programs to improve handball players' throwing.
14	Henderson et al., 2019	Conditional quality and team sports	Experimental study	The study examined the effect of a number of individual factors and characteristics on physical and technical performance values in rugby matches. The results showed that it is necessary to develop high aerobic and anaerobic fitness skills during preparatory periods to enable improved physical performance during matches.
15	Silva et al., 2019	Conditional quality and team sports	Systematic Review	Included studies have indicated that plyometric training appears to increase vertical jump performance, strength, horizontal jump performance, flexibility and agility/speed in volleyball players.
16	Lum et al., 2020	Conditional quality and team sports	Systematic Review	Increased muscle strength is associated with increased muscle power, improved jumping, sprinting and change of direction.
17	Nishiumi et al., 2023	Conditional quality and team sports	Systematic Review	This review examined studies that investigated the associations of eccentric force variables during jumping and lower limb eccentric force with vertical jump performance. Jump height is associated with sprinting and change-of-direction ability as well as competitive level in volleyball, soccer, and basketball. Improving eccentric muscle strength can contribute to vertical jump height.
18	Thurlow et al., 2023	Conditional quality and team sports	Systematic Review	Neuromuscular, physiological, and performance demands of Repeated sprint training (RST) are substantial. To amplify physiological demands and performance decrement, longer (> 30 m) and shorter sprint distances, rest between repetition (≤ 20 s) are recommended.
19	Loturco et al. (2018)	Conditional quality and team sports	Experimental study	The results have a significant impact on applied practice and research, as jump-based measurements can be considered as one of the most practical and useful approaches to assessing elite athletes. In addition, the results provide valuable information on the specific role played by vertically or horizontally directed movements in the distinct phases of sprint performance.
20	Delves et al., 2021)	Performance analysis and team sports	Systematic Review	Acceleration events in team sports research have been quantified predominantly through the use of effort counts, including time-related counts. Global positioning systems and now GNSS are the most common tracking systems used for quantifying acceleration in team sports athletes.

for example, the number and type of direction changes, total distance traveled and distance traveled at various speeds, and the number of accelerations and decelerations (Harper et al, 2019). An additional aspect to be monitored there is the performance trend between the first and second half of

the race, in which a decrease in performance by athletes can often be evidenced, so it is important to know the extent of it (Ortega et al, 2020). The performance model is used as a reference for monthly, weekly, daily and single exercise load. To summarize: team sports require athletes to have

highly developed speed, agility, muscular strength, power, and endurance (Suchomel et al., 2016a), but also the ability to repeatedly perform complex motor skills (e.g., passing, defending and countering, running, and jumping) under pressure and in fatigue (Rampinini et al., 2009). Finally, a programmatic goal of interest and in common among the different team sports analyzed is certainly the improvement of vertical jump performance; not surprisingly, jump height has a correlation with sprinting (Loturco et al., 2018) and change-of-direction ability (Hernández-Davó et al., 2021), both in volleyball (Sattler et al., 2015), soccer (Haugen et al., 2012), basketball (Spiteri et al., 2019) and rugby (Parmar et al., 2018). Knowledge of these common determinants, along with the specific performance model of each team sport, is useful in order to better define and design improved practices of different performance elements.

Correlations and Significant Effects

Strength: In most team sports there are several factors that influence performance (strength, speed, endurance, and highly coordinative specific motor skills) but without neglecting some aspects related to various expressions of strength (Gamble, 2013), sprinting ability, maximal oxygen consumption, and ability to recover from maximal efforts. There are strong correlations between the characteristics of strength training (maximum dynamic force, power) and sports skills such as speed, jumping and agility (Lum et al., 2020). An increase in muscle strength is consequently associated with an increase in muscle power, jumping ability, sprinting and change of direction (Nishiumi et al., 2023). In addition, strength training interventions improve performance in several other sports such as swimming (Crowley et al., 2017), cycling (Sunde et al., 2010) and endurance running (Lum, 2016).

Sprint: Sprint performance is an important factor (Izzo et al., 2020; Thurlow et al., 2023) and can often lead to athletic success (Winchester et al., 2008). Sprint performance has been shown to be an important determinant of winning actions in several team sports such as rugby, soccer, and basketball (Alemdaroglu, 2012; Sims, 2017). The importance of sprint performance for athletes in team sports is evidenced by the observation that straight sprinting is a frequent action preceding a goal in soccer, a counterattack in basketball, a goal in rugby (Faude et al., 2012), etc. High sprint performance depends on stride length and stride frequency. Improvement in sprinting requires an increase in one or both of these parameters. Improvements in stride length are related to improvements in power, the latter in turn being directly related to maximal strength, elastic force and dynamic flexibility.

VO₂max: Other parameters to consider, for the purpose of sports performance in team sports, is maximum oxygen consumption (VO₂max) and the ability to recover from short, repeated high-intensity activities. The most widely accepted measure of aerobic capacity is VO₂max, which represents the maximum speed at which aerobic metabolism can supply energy (Castagna & D'Ottavio, 2001). The importance of VO₂max can be seen from an established correlation between VO₂max and distance traveled during team sports (Fernandes da Silva et al., 2010). Athletes with a high VO₂max are better able to maintain power during a

repeated sprint exercise (Glaister, 2005); moreover, detecting an increase in VO₂max is the most common method of ascertaining a training effect (Edge et al., 2006). In the literature, it has been shown that a high level of aerobic capacity is a prerequisite for superior anaerobic performance during prolonged intermittent activities (Seiler et al., 2013) and that a high level of aerobic capacity improves recovery after high-intensity exercise (Tomlin, 2001).

Practical Applications in Different Team Sports, Based on the Performance Model

Based on the performance model of each team sport, conditional-type training proposals should develop according to the following indications:

With regard to soccer, drills should involve a high level of aerobic endurance in combination with intense and short repetitive actions (Hostrup & Bangsbo, 2023). Physical conditioning in soccer should involve intermittent high-intensity actions (anaerobic endurance), such as fast movements, high metabolic load distance, sprint running, maximal speed (Redkva et al., 2018). Neuromuscular qualities, such as strength and power (jumps, acceleration, deceleration) and related to aerobic endurance (distance traveled, distance traveled less than 6 km/h, distance traveled between 21 and 24 km/h, metabolic power) provide a competitive advantage (Silva, 2022), as it predisposes players to better resistance to fatigue (Silva et al., 2017) and faster post-match recovery (Hader et al., 2019).

Basketball requires a good level of aerobic endurance, a large number of jumps, stops, changes of direction and short sprints at high intensity, in combination with passing and shooting. The game of basketball is characterized by short, intense periods of activity at medium to high frequency; such activity requires aerobic and anaerobic capabilities, both of which affect anaerobic performance (Gottlieb et al., 2021). Conditioning in basketball, involves speed above 18 km/h, maximal accelerations and decelerations, along with stops, restarts and jumps have been found to be major determinants of performance in basketball (Svilar et al., 2018). Because players' movements are carried out over small spaces, this requires a higher number of accelerations/decelerations and more intense movements (Halouani et al., 2014); in addition, elite players appear to be more efficient and effective while moving around the court (Petway et al., 2020).

Handball being characterized by motor skills such as speed, explosive power, endurance and strength, involves acceleration, deceleration and changes of direction in relation to the ball and the opponent, results in high levels of internal and external load (Ortega-Bacerra et al., 2018). Identifying these specific requirements is a key aspect in designing specific training programs, such as plyometric training (Hamami et al., 2019). Programming, therefore, drills on a good level of aerobic endurance is appropriate, such as including sessions for upper limb strength development for passing and shooting, and lower limbs for jumping (Povoas et al., 2012). Precisely because, in handball, throwing speed is strongly associated with both lower limb and upper limb strength; finally, jumping and sprinting skills should not be neglected, which play a relevant role in throwing performance.

Rugby requires a good level of aerobic endurance and strength, in the development of the game needs to maintain

a high pace of play (high time of ball possession), perform high-intensity drills in combination with countering, pushing and tackling (Colomer et al. 2020). The most relevant determinants for rugby players turn out to be aerobic/anaerobic endurance (perceived exertion rating, increased weekly load, heart rate, high speed distance), in combination with impacts, collisions, and tackles that are equally important (Henderson et al., 2019).

Volleyball is a very explosive and predominantly anaerobic intense sport in which anthropometric and somatotypical characteristics have a strong influence. This sports discipline combines explosive movements in vertical and horizontal directions, with short recovery times (Gabbett & Georgieff, 2007, Penna et al, 2023) that requires the development of endurance, speed and strength in the following expressions: explosive, resistant and reactive-elastic, endurance and speed, in which plyometric training is widely used (Silva et al., 2019). From the analysis of the performance model, it is clear that the energy system mainly involved is the alternating aerobic-anaerobic system (D'Isanto et al, 2018), with prevalence of the anaerobic-attacid one. The aspects that most characterize volleyball players are jumping ability, power and strength. Plyometric training, for example, is used to improve performance on jumps (Pereira et al, 2015). In one study (De Villarreal et al, 2009), in which free-body plyometric exercises, countermovement jumps, deep jumps and squats were used, they resulted in an increase in vertical jump height of up to 15 percent.

Conclusions

This review has highlighted important determinants of sports performance in common and uncommon among the different team sports analyzed and how they can be improved through training practices, taking into consideration the performance pattern of each team sport. In recent years, there has been a trend toward training players who are increasingly faster (maximum running speed, short and more explosive sprints) and with greater speed in performing specific techniques (e.g., passing and shooting speed). Therefore, it is necessary to resort to the use of up-to-date, evidence-based training practices and sophisticated monitoring tools. Achieving success in sport and the training of excellent players is increasingly dependent on the specificity of the coaching stimulus provided (e.g., drills adhering to the performance model of a given sport), how much more responsive to the performance model of the type of team sport, and the competence of the coaching staff (e.g., the mastery of the coach and his or her staff in the management and analysis of the match and training load). In the near future, the focus of the research could attend to individual sports, while a limitation of this review may be the use of only a few search engines.

Conflict of Interest

The author declares that he has no conflict of interest.

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Вплив факторів результативності у командних видах спорту та методологічні вказівки щодо моделі результативності: Систематичний огляд

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 10 с., 2 табл., 1 рис., 78 джерел.

Мета дослідження. Суть питання полягає в тому, чи існують спільні фактори результативності серед різних командних видів спорту. Метою цього огляду було визначити та проаналізувати ключові елементи, що впливають на фізичну працездатність у різних командних видах спорту, які можна поліпшити за допомогою тренувань, дотримуючись моделі результативності кожного командного виду спорту.

Матеріали та методи. Для відбору наукових публікацій застосовано метод, що відповідає стандарту PRISMA («Переважні елементи звітування для систематичного огляду та метааналізу»), пошукові системи Pubmed і Google Scholar, а також встановлено критерії включення. Після проведення первинного пошуку загалом було виявлено 596 публікацій. Наступний крок передбачав подальшу перевірку статей в кілька етапів з метою відбору 20 остаточних публікацій, які відповідали тематиці дослідження.

Результати. У представленому огляді висвітлено важливі детермінанти спортивної результативності, які є спільними та відмінними серед різних проаналізованих командних видів спорту, а також способи їх покращення за допомогою тренувальних практик, враховуючи модель результативності кожного командного виду спорту.

Висновки. Досягнення успішних результатів у спорті та підготовка висококласних гравців дедалі більше залежить від специфіки наданих тренерських стимулів, а також від того, наскільки це відповідає моделі результативності типу командного виду спорту та компетентності тренерського складу.

Ключові слова: аналіз результативності, умовна якість, модель результативності, практичне застосування.

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