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Physical and physiological demands of futsal

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ABSTRACT

Futsal, the 5-a-side version of soccer (i.e. 1 goalkeeper and 4 outfield players), was introduced in 1930 and continues to grow in popularity around the world. Competitive games comprise of two 20-min periods of high-intensity and intermittent activities requiring substantial physical, tactical, and technical efforts from the players. A greater understanding of the physical and skill requirements will aid the development of futsal and enable practitioners to undertake appropriate training regimes for the demands of the sport. The objective of this review is to examine key aspects of futsal such as match analysis, physiological demands, energy requirements, fitness measurements, and skill requirements. Futsal players experience fatigue as the game progresses due to the high-intensity nature of the game and the repeated maximal sprint efforts required. The intermittent nature of the sport necessitates the use of aerobic and anaerobic energy pathways throughout exercise. Therefore, a futsal player needs to have a great capacity of intermittent endurance, repeated sprint ability, and leg power, while technical aspects include the ability of high level shooting and passing skills, agility and coordination. Future research is warranted to help practitioners develop more specific tests into futsal performance, especially with regards skill.

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Introduction

Futsal is the official name for the 5-a-side indoor version of soccer (i.e. 1 goalkeeper and 4 outfield players) that is sanctioned by soccer's international governing body Federation Internationale de Football Association (FIFA). Futsal was introduced in 1930 and its popularity is growing worldwide. Since 1989, the Futsal World Cup has been contested by countries from all continents every 4 years and involved 16 teams in 1989 growing to 24 teams in 2012. Futsal is a 2 × 20-min game of high-intensity and intermittent actions requiring high physical, tactical, and technical efforts from the players. The court measures approximately 40 × 20 m with 3 × 2-m goals. Futsal is played within both professional and amateur leagues and uses a smaller (size 3 or 4) low-bounce ball, relative to normal, outdoor soccer. During FIFA-organised competitions, teams are made up from a squad of 12 players (2 goalkeepers and 10 outfield players) and unlimited substitutions are permitted. Futsal was designed to maintain the rhythm and intensity of play

throughout the match, and achieved via 'rolling' substitutions.¹ The time is stopped when the ball is out of play and for any events that may waste time, meaning that the game usually lasts 70–85% longer than the scheduled total of 40-min.¹

Despite its popularity, limited research has been undertaken into futsal possibly due to the lack of financial interest in the game (relative to soccer). And, of these research articles, most have addressed the game analysis and/or physiological demands on players during match play and training,^{1–3} with little or no evidence relating to skill performance (e.g. shooting and passing). Skilled soccer players can recognise and recall patterns of play more effectively than their less skilled counterparts.⁴ Understanding futsal skills would allow practitioners to transfer beneficial information to the player and so a greater understanding of the physical and skill requirements would certainly aid in the development of the sport. Therefore, the aim of this review is to highlight the current body of evidence relating to the physical, physiological and skill demands of futsal and identify gaps for future research.

Match analysis

There has been limited time-motion analysis of futsal players

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during match play.³ The activity patterns of futsal may differ from other sports since each player has to perform both attacking and defensive tasks constantly at a high tempo.¹ Barbero-Alvarez et al.¹ reported that futsal is a multiple-sprints sport in which there are more high-intensity phases than in other intermittent sports. Although comparing against other sports has its limitations, some useful comparisons can be made with similar intermittent team sports such as soccer, basketball, and handball. For example, it has been shown that the total distance covered at a high-intensity and maximum speed is greater in futsal than soccer,^{5,6} basketball,⁷ or handball,⁸ thus reflecting the high-intensity nature of futsal.

The work-to-rest ratio in futsal is approximately 1:1, where rest means the player is stationary, walking or jogging, and work means the distance covered at medium, high or maximum speed.^{1–3} The intensity of match play of futsal was shown to be higher than soccer,¹ possibly as a direct consequence of the unlimited substitution rule during futsal. Professional futsal players cover 13.7% of their total distance at high-intensity (speed $\geq 15 \text{ km} \cdot \text{h}^{-1}$) and 8.9% sprinting (speed $\geq 25 \text{ km} \cdot \text{h}^{-1}$)^{1–3} with players performing 8.6 activities per minute of match play.^{2,3} In addition, players perform a low-intensity effort every 14 s, a medium-intensity effort every 37 s, a high-intensity effort every 43 s, a maximum-intensity effort every 56 s,³ and change locomotor activities every 3.3 s.⁹ From these findings it can be concluded that futsal is an anaerobic multiple-sprint sport in which high-intensity exercise constitutes a greater proportion of match time than in soccer and other multiple-sprint sports.

The distance covered during futsal matches (based on five studies) can be found in Table 1. It is believed that the distance covered in a game can discriminate between levels of players. However, distance covered per minute (relative distance) seems to be more representative of the general intensity of futsal and may be used as an overall index to provide more precise information about the demands of futsal.¹ The total movement of players seems to be affected by many different parameters such as the position on the field, tactical disposition, and characteristics of the match itself, all of which in some way can affect the amount of space covered by players. Most research shows no differences between playing positions (excluding goalkeepers) in distance covered or percentage distance covered at different intensities, indicating some similarity both in the quantity and quality of the movements made by all the players on the court.¹ This evidence seems to demonstrate the versatility of futsal players. Certainly, futsal players can fulfil two or even three distinct functions depending on the circumstances of the match, the team's needs at a specific moment or the characteristics of the players on the court at that time.

The similarity in the data obtained by Oliveira¹⁰ and Barbero-Alvarez et al.¹ in comparison with Molina's¹¹ estimates appear to indicate an increase in the demands and dynamics of the game over time. The development of offensive (4-in-line) and defensive (pressure in all parts of the court) tactics has increased the demands made by competition, a fact reflected in the greater distance

covered per minute. Barbero-Alvarez et al.¹ observed a 4% increase in the total distance covered in the second half but there was a 7% reduction in the distance covered per minute. This paradox was explained by the notable 12% increase in the total time played in the second half. Moreover, the reduction in the distance covered per minute of participation in the second half may be related to the decline in the intensity or work rate towards the end of the game as a result of muscular fatigue. A reduction in the distance covered in the second half has also been observed in soccer.⁵

Barbero-Alvarez et al.¹ showed that of the total distance covered by professional futsal players, almost a quarter (22.6%) is spent at high-intensity and can, on occasions, exceed a third. During the second half, players ran fewer metres per minute and the percentage of distance covered at high speed decreased, although there were no differences in the percentages of high-intensity exercise between the two halves. Furthermore, the average distance covered by futsal players depends on the time participated in the game (range 601–8040 m).^{1,9} This variance by players demonstrates why distance covered cannot be taken as a performance indicator in futsal due to the unlimited substitutions rule, unlike other team sports such as soccer.

Running speeds at the ventilatory threshold (VT) and $\dot{V}O_2\text{max}$ were higher in professional futsal players relative to body mass-matched semi-professional players.¹² These findings are consistent with those reported by Ziogas et al.¹³ who showed running speed at lactate threshold could discriminate endurance characteristics of soccer players of different competitive levels more accurately than $\dot{V}O_2\text{max}$. These results suggest that speeds associated with $S_{\dot{V}O_2\text{max}}$ ($S_{\dot{V}O_2\text{max}}$) and VT (S_{VT}) should also be assessed in futsal players as they may better reflect competitive level differences than cardiorespiratory variables alone.¹² These findings are interesting because it is well accepted that the distance covered at high-intensity during soccer matches is a valid measure of physical performance, and discriminates players of different competitive levels.¹⁴ However, there is no similar information in futsal. A greater distance covered at high intensities in those players with higher S_{VT} and $S_{\dot{V}O_2\text{max}}$ would be expected.¹² Although Alvarez et al.¹⁵ found that $S_{\dot{V}O_2\text{max}}$ on a treadmill was similar between professional and semi-professional futsal players there is limited information on players at different competitive levels. Therefore, further research is needed with different player cohorts to identify and discriminate possible differences between players assisting practitioners in developing suitable training requirements based on player profiling.

Physiological demands

Direct assessment of match $\dot{V}O_2$ has shown that players must be able to work at an intensity of $50\text{--}55 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ to play futsal professionally.^{15–17} Previous studies have suggested the importance of high aerobic power levels for inducing quicker recovery (e.g. improved PCR recovery) between high-intense efforts or even

Table 1

Mean and standard deviation of total distances covered and percentage of distances performed and high-intensity running and sprinting speeds.

Reference	Players	Total distance (m)	Total distance per minute covered during a game ($\text{m} \cdot \text{min}^{-1}$)	% Total distance at high-intensity running (speed $\geq 15 \text{ km} \cdot \text{h}^{-1}$)	% Total distance sprinting (speed $\geq 25 \text{ km} \cdot \text{h}^{-1}$)
Molina ¹¹	Brazil League club		108		
Oliveria ¹⁰	Portugal League club		113		
Barbero-Alvarez et al. ¹	Spanish Professional League club	4313 (range 601–8040)	117.3	13.7	8.9
Dogramaci et al. ⁹	Australian National Team	4277 \pm 1030		23.3	2.4
Dogramaci et al. ⁹	Australian State (New South Wales) League Team	3011 \pm 999		24.4	3.2

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