

SMALL-SIDED GAMES: THE PHYSIOLOGICAL AND TECHNICAL EFFECT OF ALTERING PITCH SIZE AND PLAYER NUMBERS

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Small-sided games are widely used during football practice. These games enable players to experience situations that they encounter during actual match play. By experiencing these situations during practice, players are able to improve technical, tactical and physiological aspects of their game. Previous research (see Platt et al, Autumn 2001, Insight, Issue 4, Volume 4, pp 23-24) has shown that these key aspects are differentially affected by the number of players on the pitch. At present, however, few studies have investigated how these key aspects are affected by altering other constraints inherent in small-sided games.

The present study sought to examine the physiological and technical effects of altering the pitch size and number of players in small-sided games. Participants were professional

football players (aged 17.46 ± 1.05 years) from an English 2nd Division club. They were required to play in a small-sided game (see Figure 1) in which players attempt to maintain

possession of the ball using their teammates and the target players (T). Target players were located on either side of the pitch and played for whichever team was in possession. Additional players were used as "ball boys" to limit the amount of time the ball was out of play. All small-sided games were played on an artificial pitch. Players took part in five separate sessions: (i) 1v1 on pitch sizes 5 x 10 m, 10 x 15 m and 15 x 20 m; (ii) 2v2 on pitch sizes 10 x 15 m, 15 x 20 m and 20 x 25 m; (iii) 3v3 on pitch sizes 15 x 20 m, 20 x 25 m and 25 x 30 m; (iv) 4v4 on pitch sizes 20 x 25 m, 25 x 30 m and 30 x 35 m; and (v) 5v5 on pitch sizes 25 x 30 m, 30 x 35 m and 35 x 40 m. Table 1 summarises the pitch sizes used for each small-sided game format. An exercise-rest ratio of 1:4 (3 minutes exercise, 12 minutes active recovery) was used. Thus, players performed for 3 minutes on the smallest pitch size, then following 12 minutes active recovery, they performed for 3 minutes on the middle pitch size, then following another 12 minutes active recovery, they performed for 3 minutes on the largest pitch size. During the active recovery period the players were required to perform, in pairs, 2-touch "keep-up".

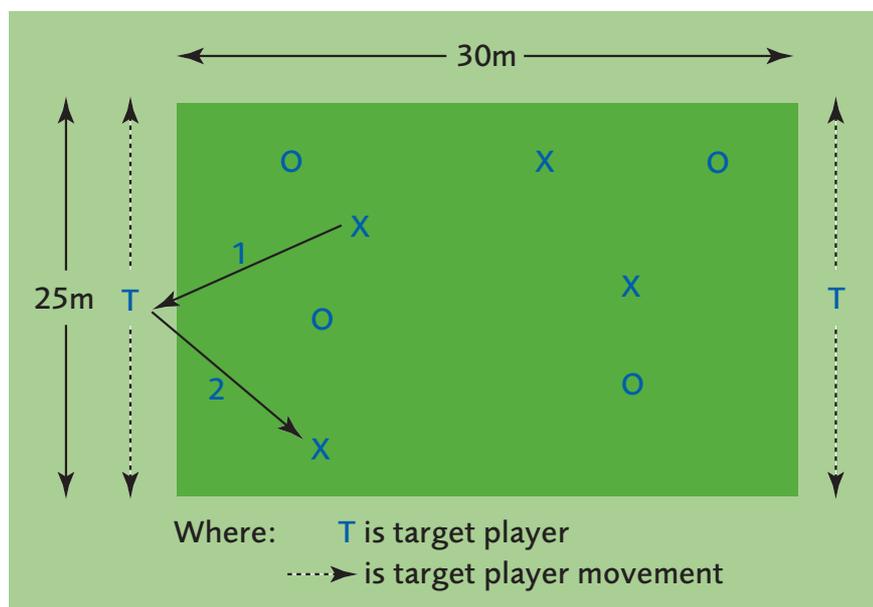


Figure 1 Example of 4 v 4 small-sided game.

Technical Analysis

A technical analysis was performed on all small-sided games. Table 2 provides a list of the skill definitions used in this study. Each game was filmed. The frequencies of each skill were subsequently recorded using hand notation. The frequencies of skills per player were then calculated. Intra-observer reliability measures ranged from 80% to 100%.

The frequency of each key action is presented in Figure 2. The most frequent technical action was passing. The second most frequent technical action was receiving. Players dribbled and turned with the ball more than they headed it, but less than they passed or received it.

Altering Player Numbers

Figure 2 shows that the addition of players (eg from 1 v 1 to 2 v 2), irrespective of the pitch size, generally led to an increase in the total number of technical actions performed. This increase was due to a greater number of passes and receptions. However, Figure 3 demonstrates that the addition of extra players led to a decrease in the total number of technical actions performed per player. The two players involved in the 1 v 1 game performed the highest amount of technical actions per player. In comparison, the ten players involved in the 5 v 5 game performed the least amount of technical actions per player. The addition of extra players also led to a decrease in the amount of one touch passing. However, altering player numbers, did not affect the amount of technical errors (eg misplaced passes, blocked passes) that the players made. Furthermore, in comparison to all other formats, players performed more turns in the 1 v 1 game and dribbled more during the 1 v 1 and 2 v 2 games. For the target players located on either end of the pitch, the addition of players (eg from 3 v 3 to 4 v 4) generally led to a slight decrease in their involvement. These target players predominately performed one touch passes.

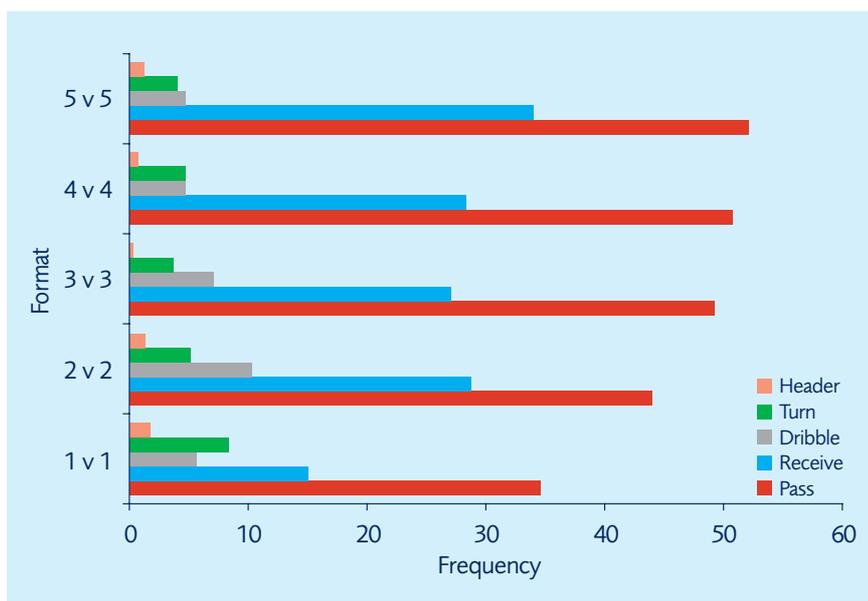


Figure 2 Frequency of skills performed per small-sided game, regardless of pitch size. A total of two target players were also used in each condition.

Table 1 PITCH SIZES (METRES) USED FOR SMALL-SIDED GAMES

Pitch size	1 v 1	2 v 2	3 v 3	4 v 4	5 v 5
Small	5 x 10	10 x 15	15 x 20	20 x 25	25 x 30
Medium	10 x 15	15 x 20	20 x 25	25 x 30	30 x 35
Large	15 x 20	20 x 25	25 x 30	30 x 35	35 x 40

Table 2 THE TECHNICAL DEFINITIONS EMPLOYED IN THIS STUDY

Skill	Definition
Pass	Player in possession sends the ball to a team mate (eg using the foot, thigh or chest; using various techniques such as ground, lofted, chip, flick or volley; over short or long distances).
Receive	Player gains or attempts to gain control of the ball in order to retain possession.
Turn	Player in possession, with ball at feet, changes direction in order to play in other areas of the pitch.
Dribble	Player in possession, with ball at feet, runs with ball, beats or attempts to beat an opponent.
Header	Player contacts the ball using their head.
Tackle	An action intending to dispossess an opponent who is in possession of the ball.
Block	Ball strikes a player, preventing an opponent's pass from reaching its intended destination.
Interception	Player contacts the ball enabling him to retain possession, preventing an opponent's pass from reaching its intended destination.

Figure 4 shows that the addition of players, regardless of the pitch size, had little effect on the number of defensive actions performed. However, as players were added, there was a decrease in the amount of tackles performed. In the 2 v 2 and 3 v 3 games, there were less blocks and interceptions when compared to the other formats. Additionally, there was a similar frequency pattern for defensive actions in the 4 v 4 and 5 v 5 games. Both formats had more blocks than tackles, and more tackles than blocks, suggesting that the two formats are similar.

Altering Pitch Size

Figure 5 demonstrates that, regardless of player numbers, increasing the size of the pitch (ie small to medium to large) had little effect on the technical actions the players performed. However, as pitch size became larger, less passes and receptions were made, although this was not significant. It may be that the increases in pitch size, by 5 metres in width and breadth, were not large enough to affect the results of the technical analysis. Furthermore, the altering player numbers may have confounded the findings. Further research is required to examine the technical effects of altering the size of the pitch for small-sided games.

Physiological Analysis

Heart rates were measured using the Polar Team System UK heart rate monitoring system. Heart rates were measured during all small-sided games. Two baseline measures were also obtained. Each player's maximum heart rate was measured as he performed the 20 m Multi-Stage Fitness Test (20 m MSFT) in a laboratory. Moreover, each player's heart rate was measured during two 11 v 11 competitive matches.

The player's mean maximum heart rate, determined from the 20 m MSFT, was 205 ± 5 beats/min. The mean heart rates in the 11 v 11 competitive match were 171 ± 11 beats/min in Match 1 and 167 ± 7 beats/min in Match 2. These values equate to 83.4% and 81.3% of mean maximum heart rate, respectively. The mean peak heart rates in the 11 v 11 competitive match were 198 ± 9 beats/min in

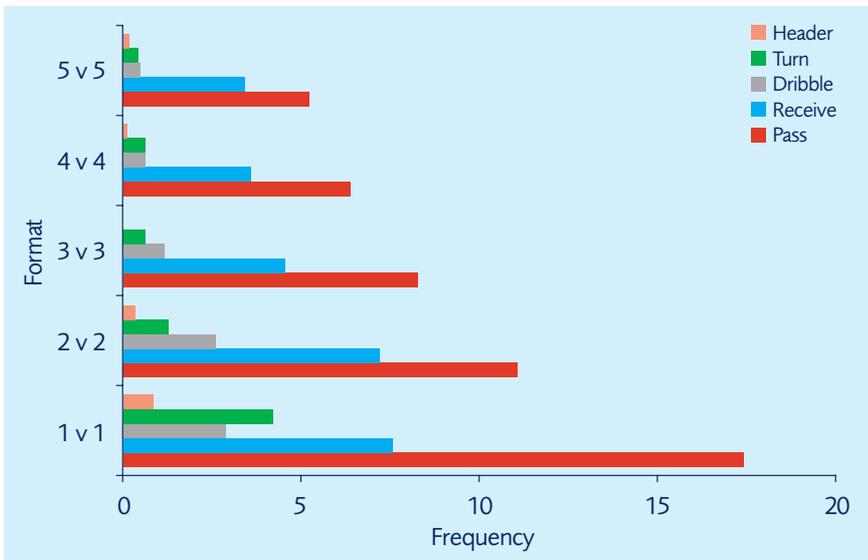


Figure 3 Frequency of skills performed per small-sided game by each player, regardless of pitch size.

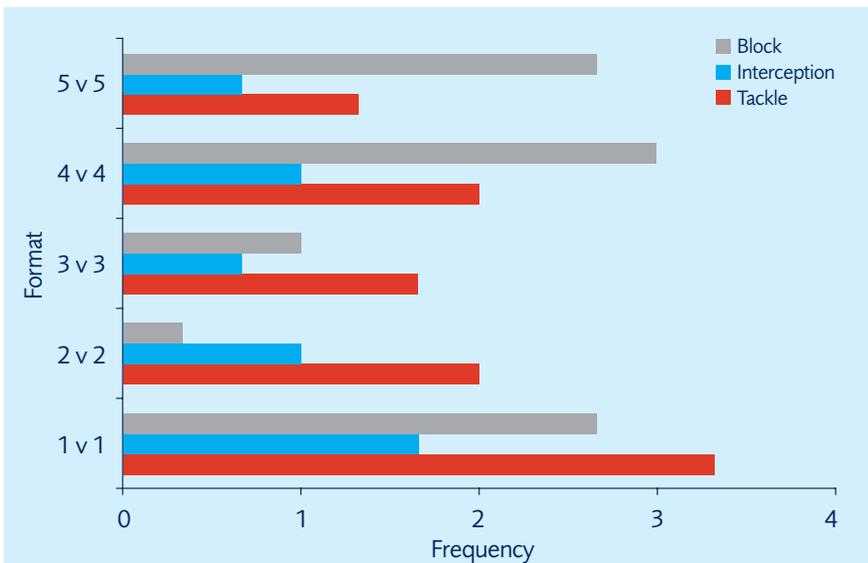


Figure 4 Frequency of defensive skills performed per small-sided game, regardless of pitch size.

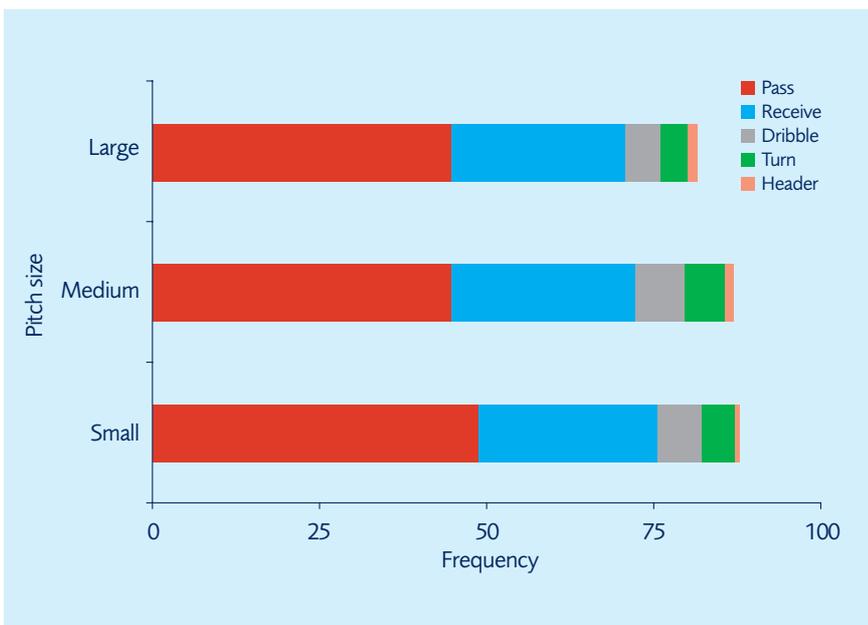


Figure 5 Frequency of skills performed per small-sided game, regardless of player numbers.

Match 1 and 191 ± 7 beats/min in Match 2. These figures equate to 96.5% and 93.1% of mean maximum heart rate, respectively.

Altering Player Numbers

Figure 6 shows that the small-sided games of 3 v 3 produced mean heart rates similar to those found in the 11 v 11 competitive matches. The small-sided games of 1 v 1 and 2 v 2 produced mean heart rates generally higher than those found in the 11 v 11 matches, whereas 4 v 4 and 5 v 5 produced mean heart rates generally lower than those found during the 11 v 11 matches. Adding an extra player to each team, but keeping the pitch size the same, generally reduced mean heart rates. Figure 7 demonstrates that the small-sided games of 1 v 1, 2 v 2 and 3 v 3 produced mean peak heart rates similar to those found in the 11 v 11 matches. However, the small-sided games of 4 v 4 and 5 v 5 produced average peak heart rates approximately 20 beats/min lower than those found during the 11 v 11 matches.

Altering Pitch Size

Figure 6 demonstrates that as the pitch size became larger, but the player numbers remained constant, mean heart rates generally increased. Similarly, Figure 7 shows that mean peak heart rates also generally increased as pitch size became larger, but player numbers remained unchanged.

Summary

The purpose of this study was to examine the physiological and technical effects of altering pitch size and number of players in small-sided games. By changing the number of players, both the technical and physiological demands of games were altered. In general, an increase in the number of players performing in the game led to an increase in the total number of technical actions performed. However, the addition of extra players also led to a decrease in the total number of technical actions performed per player. By adding an extra player to each team, but keeping the pitch size the same, mean heart rates and mean peak heart rates were generally reduced. These results demonstrate that by altering the number of players on the pitch, the coach can manipulate the physical and technical demands of the game. For example, by removing players from each team, these demands can generally be increased. When altering pitch size (by up to 10 metres), this study demonstrated that the physiological demands were more affected than the technical demands. In general, as the pitch size became larger, mean heart rates and mean peak heart rates increased.

Coaches and physiologists may use the findings of this study when planning seasonal programs and practice sessions. For example, 1 v 1 and 2 v 2 generally facilitated the highest number of technical actions performed per player, as well as the highest mean heart rates. These formats could be used to improve the player's

technique and fitness. However, throughout the course of the season, as the player's fitness improves, they may adapt to the various formats of small-sided games. This would be indicated by the players having lower heart rates, when doing the same amount of work, than they did at the earlier date. At this point the coach can condition the game (eg 2-touch, man-to-man marking) so as to increase the speed of play and cause heart rates to rise. Alternatively, this study has demonstrated that heart rates can be elevated by enlarging the size of the playing area. Certainly, constant monitoring of heart rates during practice is recommended to ensure the correct heart rates are being induced. The main findings of this study are highlighted below:

- Adding players to a small-sided game generally caused a decrease in mean heart rates and a decrease in mean peak heart rates.
- Adding players to a small-sided game generally caused the total number of technical actions to increase, but generally decreased the total number of technical actions per player.
- Adding players to a small-sided game caused a decrease in the total number of technical actions performed by target players located around the periphery of the pitch.
- Enlarging the pitch size used for the small-sided game by 10 metres generally caused mean heart rates to increase and mean peak heart rates to increase.
- Enlarging the pitch size used for the small-sided game by 10 metres had no effect on the technical actions the players performed, although this finding may have been confounded by the change in number of players.
- In comparison to 11 v 11, the 3 v 3 game generally facilitated similar mean heart rates and the 1 v 1 and 2 v 2 games generally facilitated similar mean peak heart rates.
- In comparison to 11 v 11, the 1 v 1 and 2 v 2 games generally facilitated higher mean heart rates, whereas the 4 v 4 and 5 v 5 games generally facilitated lower mean heart rates.
- Players passed the ball more than they did any other technical action in the small-sided games

● Players turned more in the 1 v 1 game than they did in the other formats.

● Players dribbled more in the 1 v 1 and 2 v 2 games in comparison to the other formats.

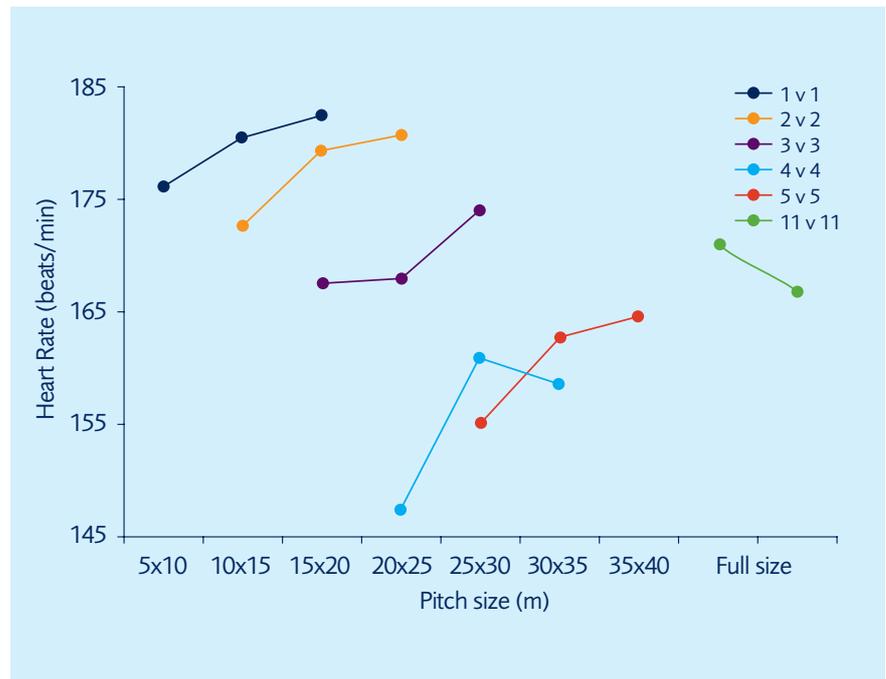


Figure 6 Mean heart rates during small-sided games.

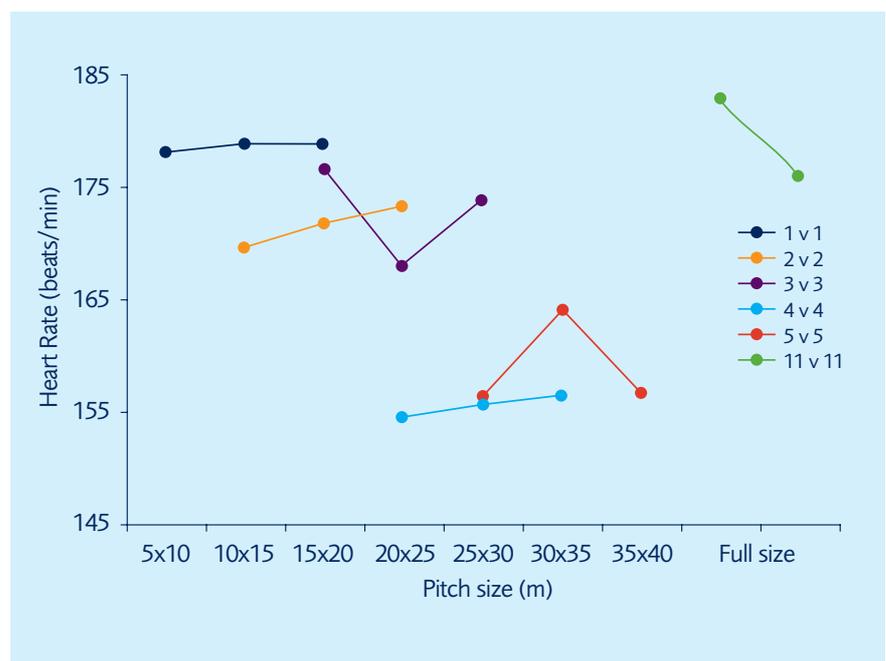


Figure 7 Mean peak heart rates during small-sided games.

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The lead author would like to thank Mr Steve Weaver at Wrexham AFC for his support during this study.