INTRODUCTION

The physiological demands of soccer play are indicated by the exercise intensities at which the many different activities during match-play are performed. There are implications not only for fitness assessment and selection of players but also for their training regimes. Since the training and competitive schedules of players comprise their occupational roles, there are consequences too for their habitual activities, daily energy requirements and energy expenditures. Finally, there are repercussions for the prevention of injuries as far as is possible.

The exercise intensity during competitive soccer can be indicated by the overall distance covered. This represents a global measure of work-rate which can be broken down into the discrete actions of an individual player for a whole game. The actions or activities can be classified according to type, intensity (or quality), duration (or distance) and frequency. The activity may be juxtaposed on a time-base so that the average exercise-to-rest ratios can be calculated. These ratios can then be used in physiological studies designed to represent the demands of soccer and also in conditioning elements of the soccer players’ training programmes. These work-rate profiles can be complemented by monitoring physiological responses where possible.

WORK-RATE PROFILES

Outfield players cover 8-12 km during the course of a match, more or less continuously. The overall distance encompasses over 1000 different activities in a game, an all-out sprint every 90 s and a break in the level or type of activity every 5-6 s. The ratio of low-intensity to high-intensity exercise is about 2.2 to 1 in terms of distance covered but 7 to 1 in terms of time. These ratios denote a predominance of aerobic metabolism whilst it is acknowledged that crucial aspects of play may depend on anaerobic metabolism (Reilly, 1996).

Positional role influences the work-rate profile, the greatest distance being covered by midfield players (Reilly and Thomas, 1976). The style of play also affects overall work-rate, the direct method or pressure game being energetically demanding. Performance tends to fall towards the end of the game, reflecting the onset of fatigue.

PHYSIOLOGICAL RESPONSES TO PLAY

Physiological responses to soccer confirm the predominantly aerobic nature of activity. Average heart rates are around 170 beats min" with only small variations about this value. Estimates of metabolic loading suggest that the relative VO$_2$ during soccer is about 75% VO$_2$ max (Bangsbo, 1994). Muscle glycogen stores can be depleted towards the end of a game and their reduction accompanies fatigue. Blood lactate values are variable, being dependent on the activity profile prior to sampling. Game skills such as dribbling the ball and unorthodox movements add to the energetic demands of the game (Reilly and Ball, 1984). This has implications for the use of the training drills with the ball.
FITNESS MEASURES

The fitness requirements for football depend on the level of performance, positional role and styles of play. They vary also with age groups, between men and women, and at different stages of the playing season. Re-acquiring desirable fitness levels is especially important after injury, prior to returning to competitive play. Otherwise the individual is vulnerable to re-injury if uncorrected weaknesses, in muscle strength for example, are carried into a game.

OVERVIEW

The intermittent and acyclical nature of activity during competition means that it is difficult to model game-related protocols in laboratory experiments concerned with soccer. It is likely that field studies with a greater specificity to the game will be employed more in future investigations of the physiology of soccer. The work-rate and activity profiles can be used to design appropriate training protocols to optimize fitness and ensure that performance during play is enhanced. Whilst physiological considerations have a place in a systematic preparation for competition, performance ultimately depends on the quality with which individual skills and team tactics are executed.

REFERENCES