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# The importance of aerobic fitness for tennis: a review (part 1)

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ABSTRACT

Tennis is an intermittent sport involving different physical components, one of which is aerobic fitness. Scientific research has provided information about the physiological demands of tennis competition and some specific protocols have been developed to combine aerobic testing with technical efficiency testing and training. This paper will provide a rationale behind aerobic fitness training for tennis players.

**Key words:** aerobic fitness, heart rate, VO2max.
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## INTRODUCTION

A tennis match is characterized by intermittent exercise, alternating short (4–10 second) bouts of high intensity and short (10–20 second) recovery periods, interrupted by several rest periods of longer duration (60–90 seconds). The running activities of players are comprised of quick accelerations and decelerations but low velocities reflecting the intermittent play involved in tennis, which does not allow high velocities to be reached (Hoppe et al, 2014).

If the crucial muscle actions (movement and strokes) are explosive by nature and rely mostly on anaerobic breakdown of creatine phosphate for energy production, aerobic power (VO2max) is a variable that promotes better physiological recovery between these actions, matches and tournaments. Thus, tennis could be classified as a predominantly anaerobic activity, requiring high levels of aerobic conditioning to avoid fatigue. Indeed, the aerobic fitness status of players may largely determine their capacity to sustain high-intensity exercise during a match and may even influence a player's technical and tactical performance by allowing them to make better choices under fatigue.

It has been suggested that VO2max values >50 ml/kg/min for males and > 42 ml/kg/min for females should be generally considered the minimum standard, with preferably higher values being encouraged for tennis athletes to be able to practice and compete at a high level (Kovacs, 2007). These values are quite similar to those required in most of team sports when competing at a high level. In recent years, scientific research has shown a growing interest in the development of testing protocols allowing for coupled analysis of aerobic fitness and technical production (Baiget et al, 2014; Brechbühl et al, 2016). The goal of this paper is to provide a rationale behind aerobic fitness training for tennis players.

## HEART RATE AND PHYSIOLOGICAL STRAIN DURING TENNIS PLAY

Heart rate (HR) monitoring is the most popular indirect method of estimating intensity of exercise and it is used to provide information about the psychophysiological stress associated with match play. During competitive matches, mean HR values ranges between 60–80% of maximum HR (HRmax), with long and intense rallies eliciting values at over 95% of HRmax (Fernandez et al, 2006).

But average HR values should not be the sole measurement of metabolism, as this would not accurately represent the intermittent nature of tennis play and could lead to misinterpretation (figure 1). Thus, the HR-based model defining three intensity zones (low intensity < 70%HRmax; moderate intensity < 85% HRmax; high intensity > 85% HRmax) is commonly used to examine physiological strain during various types of exercise.

The analysis of relative intensity based on the cumulative time (actual – or effective playing time – with the addition of rest periods) spent in these three metabolic intensity zones during simulated tennis play has revealed that players spent more than 75% of the time in the low-intensity zone, with less than 25% of the time spent at moderate to high intensities (Baiget et al, 2015).

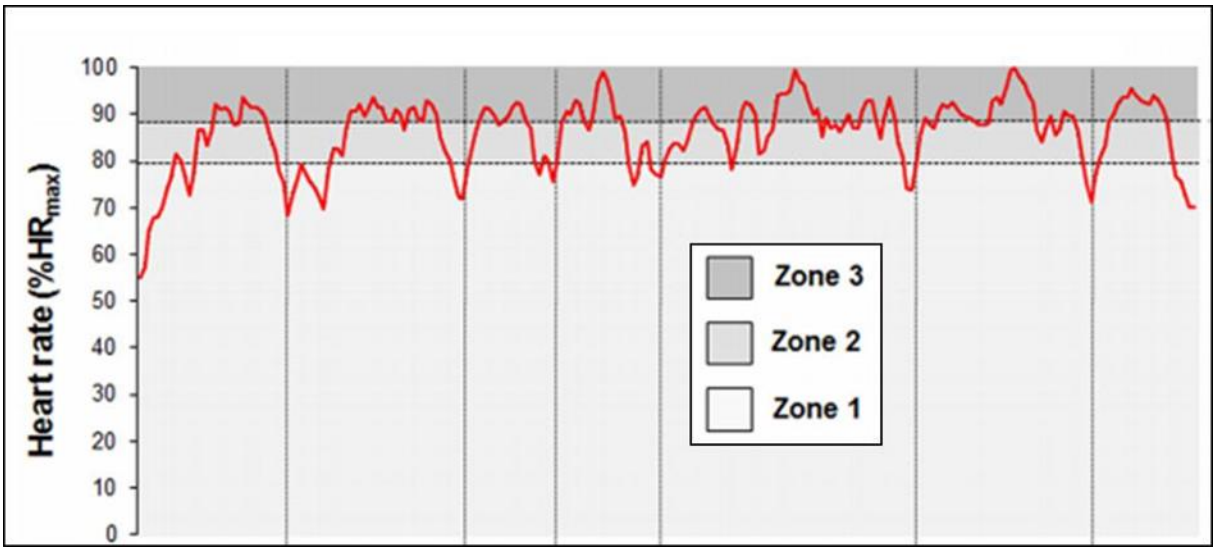


*Figure 1. HR variation during tennis match play (adapted from Baiget et al, 2015)*

The effective playing time - i.e., the player's activity during the point - based on this distribution, only accounts for approximately 20 to 30% on clay courts and 10 to 15% on hard court surfaces (Ferrauti et al, 2003). During a 60 minute match or set, this means that the player only plays 12-18 minutes and the active or passive rest accounts for 42-48 minutes.

On top of that, HR values can be affected by several factors during a tennis match. For example, it has been shown that a passive strategy (vs an active one) may place higher cardiovascular demands on the players due to longer times spent at elevated (high) heart rates (Hoppe et al, 2019). This is in line with the high relationship found between HR responses and match activity characteristics such as rally duration and strokes per rally, with serve games being more demanding than return games (Kilit & Arslan, 2017).

In the same vein, playing time on clay courts is higher than on hard courts with a lower exercise to rest ratio leading to higher mean HR (Murias et al, 2007). Moreover, the proportion of time spent in the moderate and higher heart rate zones by Elite players during a four-set match were increased following each set indicating increasing stress (Gomes et al, 2011). Thus, not surprisingly, playing style and surface are important factors which should be taken into consideration when designing training plans in order to meet the needs of the player.

In the same way, male tennis professionals performed 50% more total work in a Grand Slam matches than juniors due to the best of 5 sets format. Thus, junior players transitioning to the professional level must adapt to a field of deeper and higher-quality athletes (Kovalchik & Reid, 2017).

Baiget et al (2015) showed that players with better aerobic fitness played at relatively lower intensities and therefore at a lower level of strain and fatigue. This could be a great advantage when players have to play several matches in a short period of time, which has been shown to impair hitting accuracy and stroke positioning (Gescheit et al, 2016).

Finally, when it comes to the performance during incremental field tests specific to tennis, it has been reported that VO2 values - both at submaximal and maximal load - were moderate predictors of players' competitive rankings (Brechbühl et al, 2016 ; Brechbühl et al, 2018), and that the better aerobic conditioning levels of male tennis players at international levels were associated with better technical efficiency at higher exercise intensities compared with male tennis players at national levels (Baiget et al, 2016).

## CONCLUSION

Aerobic fitness is a factor of performance that has to be assessed and improved. The part of this series will provide coaches with practical testing and training protocols adapted to the specificity of tennis play.

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