# Exercise intensity in tennis: training drills vs simulated match play

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**Introduction**

Several investigations have examined the physiological demands of single match play in tennis based on oxygen consumption ($VO_2$), heart rate (HR) and blood lactate concentration (LA) measures (Smekal et al., 2001; Ferrauti et al., 2001). Data from these studies have allowed the design of scientifically based training protocols according to sport-specific demands. However, in tennis, the sport specific technical skills are predominant factors (Smekal et al., 2001). Therefore, tennis player devotes a great amount of time to improve their tennis skills throughout technical training. Presently, the physiological load associated to this technical training is not known (Ferrauti et al., 2001). The aim of this study was to assess the workload of a typical drill used by tennis players during their technical training sessions and to compare it to the physiological load associated to a simulated single tennis match play.

**Methods**

Six tennis players (ATP ranked and nationally ranked) volunteered to participate in this study, which was conducted over two weeks. The experimental design was divided in two parts: a maximal treadmill test and a field test. In the first part subjects completed an incremental treadmill test to exhaustion, including the measurement of maximal oxygen consumption ($VO_{2max}$), maximum heart rate ($HR_{max}$) and blood lactate concentrations (LA). In the second part, subjects performed an outdoor clay court test, consisted in 2 different technical drills (exercise 1 and exercise 2) and a competitive set (SET). Subjects were equipped with a portable metabolic system, which allowed measurement of $VO_2$ and HR. Several blood samples were taken from the earlobe at selected changeovers. The results were expressed as mean ± SD. Student t-test were used to compare mean values of physiological parameters obtained in each test. A value of $P < 0.01$ was considered as statistically significant.

**Results**

The mean (± SD) values during the incremental treadmill test to exhaustion for $VO_{2max}$, $HR_{max}$ and peak blood lactate concentration ($LA_{max}$) were 58.2 ± 2.2 $mL.Kg^{-1}.min^{-1}$; 191 ± 4 bpm; and 6.6 ± 0.7 $mmol.L^{-1}$ respectively. Table 2 shows the physiological parameters analysed during field test. The average $VO_2$ of the technical drills used in our study was 60% of $VO_{2max}$ measured on treadmill, and the percentage of $HR_{max}$ was 80% of measured in laboratory. During the competition set the $VO_2$ registered (26.6 ± 3.3 $mL.Kg^{-1}.min^{-1}$) and $HR_{max}$ (181 ± 14 $beats.min^{-1}$) were 46% and 66%, respectively, of measured in laboratory. During training drills, oxygen consumption ($VO_2$ and $\%VO_{2max}$) and average heart rates (HR and $\%HR_{max}$) were significantly higher ($P < 0.01$) than during the simulated competition set.

**Discussion/Conclusions**

During training drills (i.e., exercise 1 and exercise 2), oxygen consumption (i.e., $VO_2$ and $\%VO_{2max}$) and average heart rates (i.e., $HR_{med}$ and $\%HR_{max}$) were significantly higher ($P < 0.01$) than during a simulated competition set. $HR_{max}$ and $LA_{max}$ were not statistically different. The higher physiological load associated with this type of work, compared to the load registered during the set, would suggest that these exercises might be also used to train the hitting and ball control skills in specific situations, under conditions of physiological overload. It is reasonable to suggest that certain technical training sessions might assure a sufficiently intense training stimulus at an aerobic system level. Therefore, monitoring the physiological load associated to on-court training drills, and quantifying the workload that the tennis player withstands during the accomplishment of technical exercises would assist in the optimisation of training efficacy (i.e., combined improvement of conditional and technical abilities) in competitive tennis players.

| Parameters | Exercise 1 | Exercise 2 | SET |
|---|---|---|---|
| $VO_2$ ($mL \cdot kg^{-1} \cdot min^{-1}$) | 34,79 ± 2,2 | 35,50 ± 1,4 | **26,62 ± 3,3** * |
| $\%VO_{2max}$ [1] | 59,9 ± 5,3 | 60,9 ± 4,7 | **46,4 ± 7,2** * |
| $HR_{max}$ ($beats \cdot min^{-1}$) | 181 ± 13 | 179 ± 9 | 181 ± 14 |
| $HR_{med}$ ($beats \cdot min^{-1}$) | 169 ± 12 | 169 ± 11 | **147 ± 15** * |
| $\%HR_{max}$ [2] | 80,4 ± 8,1 | 80,0 ± 7,5 | **65,9 ± 10,2** * |
| $LA_{max}$ ($mmol \cdot L^{-1}$) | 2,9 ± 1,8 | 3,5 ± 0,7 | 4,0 ± 1,1 |

** Significantly smaller than in exercise 1 and 2 ($P < 0.01$)*

*[1] $VO_{2max}$ percentage with regard to laboratory test*

*[2] $HR_{max}$ percentage registered in laboratory*

Table 2. Physiological parameters analysed during field test

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***References***

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