

## **Reliability of a tennis-specific treadmill protocol performed in temperate and hot conditions**

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1 **Reliability of a tennis-specific treadmill protocol performed in temperate and hot**  
2 **conditions**

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9 Laboratory protocols allow for the assessment of physiological function that cannot easily be  
10 observed in the field; however, there are currently no suitably reliable protocols for the  
11 assessment of physiological responses to tennis match-play. Accordingly, the aims of this  
12 study were to design a laboratory-based, tennis-specific treadmill protocol, and determine the  
13 between-day reliability of physiological responses in both temperate and hot conditions. The  
14 treadmill protocol was designed to simulate the published time-motion (Kovacs 2006, *British*  
15 *Journal of Sports Medicine*, 40, 381-386; Filipčič & Filipčič 2006, *AUC Kinanthropologica*,  
16 42(1), 41-53) and match-play characteristics (Reid, Morgan & Whiteside 2016, *Journal of*  
17 *Sport Sciences*, 34:19, 1791-1798) of professional tennis players. The protocol comprised  
18 three sets of nine games, each consisting of six points, with 20 s rest-periods between points.  
19 The total match duration was 92.15 min, and treadmill speed ranged from 10 - 20 km·hr<sup>-1</sup>.  
20 Following approval from the institutional research ethics committee, 17 healthy, male  
21 amateur tennis players volunteered to participate (age = 24 ± 6 years; mass = 76.6 ± 10.1 kg;  
22 stature = 179.5 ± 6.5 cm;  $\dot{V}O_2\text{max} = 50 \pm 4 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ). Participants completed the  
23 treadmill protocol twice in temperate (n=12; 20.2 ± 0.6 °C; 48.1 ± 7.4% relative humidity)  
24 and/or twice in hot (n=11; 35.9 ± 0.8 °C; 50.2 ± 4.9% relative humidity) conditions, each test  
25 performed on separate days. Measures included core temperature ( $T_c$ ) via rectal thermistor,  
26 skin temperature ( $T_{sk}$ ) via skin thermistors, capillary blood lactate concentration ([BLa]) via  
27 an enzymatic method, oxygen uptake ( $\dot{V}O_2$ ) via an online system, heart rate (HR) via  
28 telemetry, ratings of perceived exertion (RPE) via the Borg scale, and perceptions of thermal  
29 sensation (TSS) and thermal comfort (TC). Physiological Strain Index (PSI) was derived  
30 from  $T_c$  and HR, and sweat rate (SR) was calculated from pre-to-post-trial nude body mass.  
31 Between-day reliability was determined using coefficient of variation (CV) and intraclass  
32 correlation coefficient (ICC). In temperate conditions,  $T_c$ ,  $T_{sk}$ , HR,  $\dot{V}O_2$ , and TSS showed  
33 the strongest reliability (all CV <5%, ICC 0.7 – 0.971) when compared to SR, PSI, [BLa],  
34 RPE, and TC (CV 5 – 16%; ICC 0.770 – 0.964). In hot conditions,  $T_c$ ,  $T_{sk}$ , HR,  $\dot{V}O_2$ , and  
35 TSS showed the strongest reliability (all CV <5%; ICC 0.862 - 0.984), when compared to  
36 SR, PSI, [BLa], RPE, and TC (CV 6 – 19%; ICC 0.829 – 0.935). The tennis-specific  
37 treadmill protocol allowed for the reliable assessment of core temperature, skin temperature,  
38 heart rate,  $O_2$  uptake, and thermal sensation, both in temperate and hot conditions. These data  
39 indicate that the protocol is appropriate for assessments of physiology-based interventions.