

Functional Hyperemia is Attenuated in Type 1 Diabetic Rats Following Static Hindlimb Contraction

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ABSTRACT

Functional hyperemia is a responsive, localized increase in blood flow following muscular contraction, which results from the accumulation of metabolites in the contracted region. Type 1 diabetes (T1DM) is associated with reduced vascular function and an abnormal cardiovascular response to exercise; it is not known, however, if the reactive increase in blood flow succeeding exercise is also impaired in T1DM.

PURPOSE: The purpose of this study was to determine the effects of T1DM on functional hyperemia following static muscle contraction. **METHODS:** We injected (i.p.) 50mg/kg of Streptozotocin (STZ) or the vehicle (CTL) in male and female Sprague Dawley rats and waited 1-2 weeks before performing experiments (STZ: BW=300.6±23.39 g, glucose=461.8±43.78 mg/dl, n=5; CTL: BW=403±39.63 g, glucose=187.7±8.22 mg/dl, n=6). During the experiment, in decerebrate, unanaesthetized rats, we statically contracted the left hindlimb muscles for 30s by stimulating the sciatic nerve. Changes in Popliteal blood flow were measured using an ultrasonic flow probe (Transonic). The blood flow response was assessed 5 s before, 30 s during, and 30 s after muscle contraction and compared between STZ and CTL rats. **RESULTS:** The functional hyperemic response was assessed by calculating both the incremental (AUC_i) and total (AUC) area under the curve of the blood flow response during the 30s following the cessation of contraction. We found that STZ rats displayed both significantly lower AUC_i (STZ: 0.0681±0.0112 ml/min × 30 s; CTL: 0.5694±0.1239 ml/min × 30 s; p=0.003) and AUC (STZ: 0.210±0.0439 ml/min × 30 s; CTL: 1.439±0.210 ml/min × 30 s; p<0.001) compared to CTL rats. Further analysis revealed that blood flow was lower in STZ rats at each time point from 15 s to 30 s (p<0.05) after contraction. The developed tension was similar between groups (p>0.05). **CONCLUSION:** We conclude that popliteal artery blood flow is significantly attenuated in T1DM rats compared to healthy controls following static muscle contraction. These results suggest that T1DM impairs functional hyperemia in this model.