

Individualised training duration induces similar physiological and performance benefits at different intensities

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Abstract

Background: When comparing the effects of different training intensities, studies often standardise for energy expenditure. These studies tend to suggest that high intensity training (HIT) provides greater or similar benefits as moderate intensity training (MOD). However, the time (and energy expenditure) that an individual can sustain at the same relative intensity is highly variable. The possible impact of this variability on response to training has been largely ignored.

Purpose: The aim of this study was to compare the effects of three different exercise intensities; HIT, MOD and a combination of the two (MIX) when the training duration is individualised.

Methods: Participants were sedentary and recreationally active males and females training < 4h/wk. Thirty-four participants (mean \pm SD; age 28 ± 9 yr, mass 75.8 ± 12 kg) were randomly assigned to the MOD ($n=11$; $VO_{2max} = 3.37 \pm 0.79$ l.min⁻¹); HIT ($n=12$; $VO_{2max} = 3.12 \pm 0.58$ l.min⁻¹) and MIX ($n=11$; $VO_{2max} = 3.75 \pm 0.67$ l.min⁻¹) training groups. Before and after 4-wks of supervised training (4 times/wk.) we measured VO_{2max} and maximal minute power, time-to-exhaustion at 60% of maximal minute power, and cycling efficiency. The MOD group trained at 60% of maximal minute power in blocks of 5-min and 1-min passive recovery. The training duration was individualised to 100% of their pre-training time-to-exhaustion test. The HIT group trained at 100% maximal minute power for 2-min repetitions with 3-min recovery. The duration was set as the maximum number of repetitions completed in the first session and this was used as a baseline for subsequent sessions. The MIX group completed two MOD and two HIT sessions each week. All participants were encouraged to complete an extra block or repetition after every two training sessions. The effects of training were analysed using a two-way mixed ANOVA (time; training group). The level of significance was set at $P<0.05$. Effect size for each statistical test was also calculated as partial eta squared (η_p^2).

Results: Average total time spent exercising for the HIT, MOD and MIX groups was ~ 6h, 16h and 10.5h respectively. All three training groups significantly increased their VO_{2max} , maximal minute power and time-to-exhaustion following 4-weeks of training ($P<0.05$). However, there were no significant differences between groups for VO_{2max} ($P=0.378$, $\eta_p^2=0.06$); maximal minute power ($P=0.634$, $\eta_p^2=0.03$) and time-to-exhaustion ($P=0.582$, $\eta_p^2=0.03$) ($P<0.05$). There was an interaction effect for cycling efficiency ($P=0.02$, $\eta_p^2=0.22$). A follow up test revealed no difference between groups at baseline (all $P>0.590$) and a significant increase in cycling efficiency for the MIX group only ($P=0.009$). Inter-individual differences in training responses were high for all variables.

Discussion: When training durations are tailored to each individual, similar improvements are found in VO_{2max} , maximal minute power and time-to-exhaustion, despite a substantially greater time spent training at MOD intensity. A significantly greater increase in cycling efficiency following MIX training warrants further investigation, with research suggesting that training based on a polarised distribution might be more beneficial, avoiding training monotony (Neal et al., 2013: Journal of Applied Physiology, 144 (4) 461-471).

Conclusion: These findings support the contention that individualised HIT and MIX are time-efficient training strategies inducing similar changes when compared to MOD.

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