

## Effect of altitude on 100-m sprint performances

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A fair system of recognising athletics records should consider the influence of environmental conditions on performance. The IAAF has a  $2 \text{ m}\cdot\text{s}^{-1}$  wind limit for the sprints, but there is currently no restriction on the altitude of the competition venue even though there is strong empirical evidence that performances are enhanced at high-altitude venues. Published results from sports competitions can be an inexpensive source of data for biomechanical and physiological studies. The aim of the present study was to determine the effect of altitude on 100-m sprint performance by comparing race times at the 1968 Olympic Games in Mexico City (altitude 2250 m) to those from other competitions.

The electronic times for all of the 100-m races at the Olympic Games between 1960 and 2004 were obtained from an athletics statistics database. Times were corrected for the effect of wind (Linthorne, 1994: *Journal of Applied Biomechanics*, 10, 110–131), and the historical improvement in 100-m performances was accounted for by applying a correction based on the trend in the world rankings over last sixty years. The athlete's best corrected performance in the competition was identified and the athletes were ranked according to this performance. The average time of the top-50 athletes in the competition was then calculated. The improvement in race time due to competing at an altitude of 2250 m was determined by comparing the average time at the 1968 Olympic Games in Mexico City to the average times from the other competitions.

This study confirmed that 100-m sprinters derive a substantial performance advantage when competing at a high-altitude venue. The best estimate of the time advantage of Mexico City is  $0.21 \pm 0.03$  s for men and  $0.16 \pm 0.05$  s for women. The result for the women is less certain than that for the men because of the rapid improvement in sprinting standards during the 1960s and 1970s. This study indicates that an altitude of 1000 m provides a time advantage that is equivalent to a  $2 \text{ m}\cdot\text{s}^{-1}$  tail wind (about 0.10–0.12 s). Competition venues above 1000 m should therefore not be considered when recognising record performances. Such a rule would prevent records that have little chance of being bettered at venues close to sea level.