how sex, age and trade-offs shape human running performance

Erik Postma
Institute of Evolutionary Biology and Environmental Studies, University of Zurich, Switzerland

Evolutionary biologists are usually the first to emphasise that Darwinian fitness has little in common with the meaning that is usually attached to fitness by the general public, that is physical fitness. However, recent studies suggest an important role for physical fitness in shaping variation in Darwinian fitness via both natural and sexual selection, also in humans.

Studies on human running performance often focus on sex- and age-specific world records, but what about the rest of the pack? And how do population- and individual-level patterns differ?

Data

Data from 2001 to 2012 for 3 popular Swiss running events with 1000 - 4000 participants per year

Bremgarten-Reuss Lauf (11 km), Zurich Marathon (42.2 km) and 100 Kilometer Lauf von Biel (100 km)

84,237 running times by 40,222 runners, with many having run multiple distances and/or the same distance multiple times

Analyses

Running times, both unstandardised and standardised


Mixed models including individual mean distance or age and deviation from mean

Sexual dimorphism

Women get proportionally faster on longer distances (>10 km) compared to men (●). This pattern is not visible when looking at the winning times alone (●). Relatively slow women only running short distances results in an overestimation of the sex difference at short distances (●).

Ageing

Changes with age across (——) and within individuals (men: ; women: ) are different

Different effects of training/experience and ageing on short- and long-distance running performance

Similar patterns between men and women

Trade-offs

Relative running performance is positively correlated across distances

Among those runners that ran both 11 and 100 km, those that were relatively fast over 11 km, did relatively worse at 100 km. Suggestive of a trade-off between short- and long-distance performance

Conclusions

Women are relatively fast over longer distances

Older runners are faster over longer distances

Positive effects of training and experience cannot offset negative effects of ageing

Performance is positively correlated across distances, but relatively fast short-distance runners perform relatively worse on longer distances

Questions

Representative for the rest of the human population?

Different selective pressures on male and female long- and short-distance running performance?

How does selection for long- and short-distance running performance change with age?

Morphological, physiological and genetic correlates of short- and long-distance running performance?