

**Born to run – And why our future depends on it**

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On the 6<sup>th</sup> May 2017, a Kenyan distance runner ran the marathon in 2:00:25 at the Monza racetrack, Italy. Although Eliud Kipchoge's time marks the fastest marathon ever run, his performance cannot be considered an official world record (currently at 2:02:57) because he benefited from unusual advantages (*eg*, car drafting and rotating pacemakers, controversial running shoes). Yet, this astonishing performance suggests that a sub 2-hour marathon under official conditions might not be so far away and demonstrates the remarkable capacity of the human body, as exemplified by Kipchoge's ability to endure a gruelling training regime (>120 miles/week at ~2400 m) in typically warm climates, helping him achieve a performance previously considered impossible. Even more important are the lessons we can learn from a global health perspective.

Current guidelines recommend that children and adolescents engage in at least 60 minutes of daily moderate-vigorous physical activity (MVPA) to promote health and cardiorespiratory fitness.<sup>1</sup> However, among “developed” westerners—and increasingly the rest of the world—the endemic inactivity trend starts early in life: 80.3% of 13–15-year-olds worldwide achieve less than 60 min/day of MVPA.<sup>2</sup> Conversely, there are data supporting the link between high levels of MVPA, high cardiorespiratory fitness and sporting success in Kenya.<sup>3,6</sup> For example, in rural school children aged 10–17 years from the Nandi county (where most successful Kenyan runners like Kipchoge are born and raised<sup>4,5</sup>), MVPA ranges from 109 to 193 min/day for girls and from 131 to 234 min/day for boys.<sup>6</sup> The maximal aerobic capacity of these children is 47.9–68.9 ml O<sub>2</sub>/kg/min for girls and 63.9–81.6 ml O<sub>2</sub>/kg/min for boys, which represents some of the highest values reported in the literature.<sup>3</sup> High MVPA levels since childhood, well above those of industrialised societies, are not only typical for rural East Africa where many children still run to school,<sup>7</sup> but also for other ethnicities that follow an ancestral lifestyle, like the *Tsimané* of Bolivia,<sup>8</sup> who have the lowest levels of coronary artery disease ever reported.<sup>9</sup>

In contrast to the predominantly ancestral way of life in rural East Africa, there is emerging evidence that in the “developed” western world, the demise in cardiorespiratory fitness tracks with the generally downward trends in physical activity. For example, from reference values for physical activity in European children aged 2.0–10.9 years (*ie*, 3842 boys and 3842 girls) from eight European countries, the percentage of children complying with physical activity recommendations was generally low and

varied considerably between countries.<sup>10</sup> The percentage of children who were complied with the recommendations of 60 or more minutes per day of physically activity ranged from 2.0% (Cyprus) to 14.7% (Sweden) for girls and from 9.5% (Italy) to 34.1% (Belgium) for boys. Moreover, daily MVPA was higher in boys and ranged from 24–52 min in boys and 24–39 min in girls, a small fraction of the MVPA reported in rural East Africa in both boys and girls and a clear north – south physical activity divide. The low MVPA in girls is particularly alarming and is in line with previous studies, and can be explained by socio-cultural factors such as greater participation by boys in sports and other extramural activities involving vigorous exercise. From a comprehensive review of maximal aerobic capacity data obtained from children in 20 European countries, Northern European countries such as Finland, Iceland and the Baltic states were the best performing nations, while three Southern European countries (Greece, Portugal, and Italy) were ranked among the six lowest countries.<sup>11</sup> This north – south divide in levels of physical activity and cardiorespiratory fitness may reflect the cultural and climatic conditions of the more affluent Northern European countries.<sup>11</sup>

Some continue to interpret the East African running phenomenon and the contrary stereotype “white men can’t run” as genetically mediated, and in doing so ignore not only the scientific literature<sup>12,13</sup>, but also history and the declining levels of physical activity and cardiorespiratory fitness in the “developed” western world. The first countries to dominate distance running in the modern Olympic era were Finland from 1912—1976 with remarkably successful athletes, regularly called “the Flying Finns”, such as Paavo Nurmi and Lasse Virén, followed in the 1980’s by great British athletes such as Sebastian Coe, Steve Ovett and Steve Cram, and more recently, Kelly Holmes, Yvonne Murray and Paula Radcliffe. If one examines current British men’s national records, aside from those of Mo Fara (who was raised in East Africa), all were set between 1965 and 1997; a time when it was common for children to walk to school or to play outdoors, and when display time (*eg*, television viewing and computing) was significantly less than it is today.<sup>2</sup> The phenomenal success of East African distance-runners in recent decades is the result of numerous factors such as favourable somatotypical characteristics lending to exceptional biomechanical and metabolic efficiency, chronic exposure to living and training at altitude from a very young age, and a strong psychological motivation to succeed athletically for the purpose of economic and social advancement.<sup>13</sup> This phenomenon is likely to continue as half of the world’s

population now live in urban areas and this trend is destined to continue, making more of the world's population prone to diseases of modern-day lifestyle. To correct this mismatch between our bodies and the modern world, we need to understand our past and find ways to match our body's design to the new world we are creating in view of establishing a successful future, as averse as possible to "diseases of civilization". A future where physical activity is, like in our ancestral past, a main component of our daily lives.

### References

1. Global Recommendations on Physical Activity for Health. Geneva; 2010.
2. Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet* 2012; **380**(9838): 247-57.
3. Gibson AR, Ojiambo R, Konstabel K, et al. Aerobic Capacity, Activity Levels and Daily Energy Expenditure in Male and Female Adolescents of the Kenyan Nandi Sub-Group. *PLoS One* 2013; **8**(6): e66552.
4. Tucker R, Onywera VO, Santos-Concejero J. Analysis of the Kenyan distance-running phenomenon. *Int J Sports Physiol Perform* 2015; **10**(3): 285-91.
5. Onywera VO, Scott RA, Boit MK, Pitsiladis YP. Demographic characteristics of elite Kenyan endurance runners. *J Sports Sci* 2006; **24**(4): 415-22.
6. Ojiambo R, Gibson AR, Konstabel K, et al. Free-living physical activity and energy expenditure of rural children and adolescents in the Nandi region of Kenya. *Ann Hum Biol* 2013; **40**(4): 318-23.
7. Ojiambo RM, Easton C, Casajus JA, Konstabel K, Reilly JJ, Pitsiladis Y. Effect of urbanization on objectively measured physical activity levels, sedentary time, and indices of adiposity in Kenyan adolescents. *J Phys Act Health* 2012; **9**(1): 115-23.
8. Gurven M, Jaeggi AV, Kaplan H, Cummings D. Physical activity and modernization among Bolivian Amerindians. *PLoS One* 2013; **8**(1): e55679.
9. Kaplan H, Thompson RC, Trumble BC, et al. Coronary atherosclerosis in indigenous South American Tsimane: a cross-sectional cohort study. *Lancet* 2017; **389**(10080): 1730-9.
10. Konstabel K, Veidebaum T, Verbestel V, et al. IDEFICS consortium. Objectively measured physical activity in European children: the IDEFICS study. *Int J Obes (Lond)* 2014; **38** Suppl 2:S135-43.

11. Olds T, Tomkinson G, Léger L, et al. Worldwide variation in the performance of children and adolescents: an analysis of 109 studies of the 20-m shuttle run test in 37 countries. *J Sports Sci* 2006; **24**(10):1025-38.
12. Rankinen T, Fuku N, Wolfarth B, et al. No Evidence of a Common DNA Variant Profile Specific to World Class Endurance Athletes. *PLoS One* 2016; **11**(1): e0147330.
13. Wilber RL, Pitsiladis YP. Kenyan and Ethiopian distance runners: what makes them so good? *Int J Sports Physiol Perform* 2012; **7**(2):92-102.