The occurrence of chronic lymphocytic leukaemia in this patient contemporaneous with his antibody positivity may be coincidental, but it also raised the possibility of various causal associations. There is evidence that other retroviruses that infect T cells can also integrate into and transform B cells in a clonal fashion.[4] Furthermore, B lymphoblastoid cell lines transformed by Epstein-Barr virus have been shown to be permissive to HIV infection.[5] Our use of the anti-HIV serum detected no viral antigens in the neoplastic B cells. Such evidence cannot, however, exclude the possibility of non-transcribed genomic integration of the virus in the cellular DNA. Such analysis will require the use of viral recombinant cDNA genotyping of the leukaemia B cells.

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Fitness, unfitness, and phosphate

We previously reported a disturbingly high prevalence of profound hypophosphataemia in runners who collapsed at the end of an annual half marathon "fun run."[1] Competitors chosen randomly from those who successfully finished the race had normal phosphate concentrations. We report here the phosphate state of men running in half marathons and full marathons and of elite athletes.

Subjects, methods, and results

Blood samples were taken at the end of each of the annual Great North Run fun runs (half marathons) held during 1981-6 from the 38 men who collapsed and from 63 male runners of the same age group who finished successfully in about the same time. Samples were also taken from seven accomplished athletes who had completed a full marathon race in which selection for the Commonwealth Games was at stake and from 29 men of undistinguished performances running in a local marathon. The half marathon takes around 90 minutes to complete, compared with three hours for a full marathon. To exclude elapsed time as a factor six accomplished athletes (two of them Olympic finalists) were subjected to strenuous runs on a treadmill for 30 minutes.

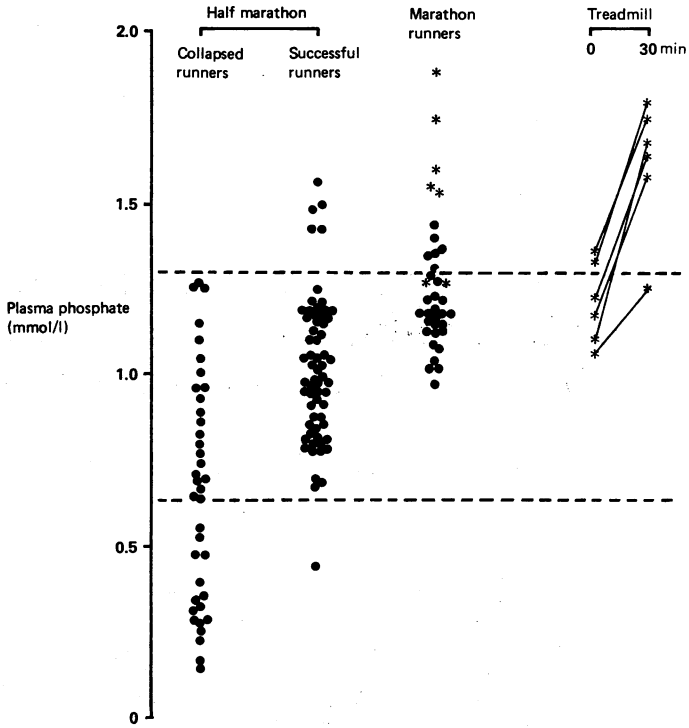
The figure shows that 16 of the 38 entrants who collapsed at the end of the half marathon fun runs had subnormal plasma phosphate concentrations; eight of these were profoundly hypophosphataemic (<0·32 mmol/l). The runners who collapsed had significantly lower phosphate concentrations (mean (SD) 0·67 (0·33) mmol/l) than those who successfully completed the same race (1·02 (0·22) mmol/l; $p<0·001$, Student's t test).

Taken together the 36 marathon runners had higher phosphate concentrations after their run (mean 1·26 (0·20) mmol/l) than the successful fun runners ($p<0·001$). The seven accomplished marathon runners were significantly hyperphosphataemic (1·55 (0·23) mmol/l, $p<0·001$) compared with the remaining marathon runners (1·19 (0·12) mmol/l), who themselves had significantly higher plasma phosphate concentrations than the fun runners ($p<0·001$).

Although the accomplished athletes undergoing the treadmill exercise had normal resting phosphate concentrations, after 30 minutes the mean concentration (1·63 (0·19) mmol/l) was significantly higher ($p<0·001$) than that in the 63 successful fun runners and that in the 29 undistinguished marathon runners but did not differ significantly from that in the seven accomplished marathon athletes at the end of their race.

Comment

Fitness is difficult to assess other than by achievement. In this study international athletes were taken to be the most fit and competitors who collapsed the least fit. If we assume that undistinguished but committed marathon runners are likely to be fitter than half marathon fun runners who jog occasionally then there seems to be a relation between plasma phosphate concentration at the end of a distance race and fitness. Many runners who collapse at the end of such runs have quite profound hypophosphataemia.



Plasma phosphate concentrations in runners at end of half marathon fun runs, marathon races, and treadmill exercise. Horizontal broken lines indicate the normal clinical reference range.
*Accomplished athletes.

Accomplished athletes characteristically raise their plasma phosphate concentration to unusually high values within 30 minutes. The modest increase in plasma phosphate concentration in marathon runners of average performance compared with half marathon fun runners may reflect the additional training commitments or an inborn metabolic advantage that is required to complete the 26 mile course.

These changes in plasma phosphate concentration probably result from shifts from the intracellular compartment, which has a phosphate concentration some 100 times greater than that of extracellular fluid.[2] Wilkie suggested that the cause could lie within the muscles, where the phosphorus transfer after exercise is rapid, being of the order of 5 mmol/l/min.[3] This may well be a factor that determines a runner's chances of winning—or of collapsing.

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