Are genes and metabolism of cyclists changing?

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During many years the metabolism of elite road cyclists –and its relationship with certain genes- has been considered as mainly oxidative, with a great use of fat a rather low glycolysis and very low lactate production. The changes in the competition models from very long stages to shorter stages and more “one day” races, could be selecting the successful cyclists from athletes with different genes and metabolism. Changing to athletes obtaining energy from nonmitochondrial sources, with greater use of glycogen, higher values of blood lactate and more muscle power. In parallel recent studies have shown (Lucia et al., in press) changes in the polymorphism of certain genes (i.e.: ACE), from the “endurance type” to the strength type.

10-15 years ago the normal physiological characteristics of world class cyclists were; mean $V\text{O}_{2\text{max}}$ (ml·min$^{-1}$)=5053, $V\text{O}_{2\text{max}}$ (ml·kg$^{-1}$·min$^{-1}$)=75.3, Power (w·kg$^{-1}$)=6.4, assessed using a standard cycle ergometer protocol. Currently even though the maximum oxygen consumption values are similar, the body weight (65 to 68kg) and the maximal power (6.4 to 6.9 w·kg$^{-1}$) are increasing. The blood lactate concentrations during intense cycling ($[La]$ in mmol L$^{-1}$) in these elite cyclists ranged from 3 to 7 mmol·L$^{-1}$, being now around 9-11 mmol·L$^{-1}$. This lactate could be of benefit under these cellular conditions to prevent pyruvate accumulation and supply the NAD($^+$) needed for phase 2 of glycolysis.

In a recent paper, Lucia et al. (2005), have examined the association between polymorphisms of the angiotensin-converting enzyme (ACE) and muscle-specific creatine kinase (CKMM) genes and the actual performance status observed in professional cyclists. To accomplish this, they compared the frequencies of the ACE and CKMM genotypes/alleles in 50 top-level Spanish professional cyclists, 119 sedentary controls, and 27 elite (Olympic-class) Spanish runners. Contrary to the findings obtained in a previous study with 51 top elite cyclists, (6 of them from the top 1º of UCI classification), 20 runners and 400 controls (Alvarez et al. 2000), the results of this recent study showed that the proportion of the DD genotype was higher in these “new” cyclists (50.0%) than in the group of cyclists from the 90’s and than other two groups (P<0.05). The proportion of the D allele was higher in this “new” cyclists (65.0%) than in runners (46.3%) (P<0.001), whereas the proportion of the I allele was higher in successful cyclists from the 90ies. We conclude that in top-level professional cyclists actually, the frequency distribution of the D allele and the DD genotype seems to be higher than in other in world class cyclists from 10-15 years ago and elite runners, in whom the I allele is especially frequent. It could indicate that the genes and metabolism of pro-cyclists “are changing”.

These results appear to indicate that in current top-level professional cyclists, the frequency distribution of the D allele and the DD genotype seem to be higher than in other world class cyclists from 10-15 years ago and elite runners, in whom the I allele is especially frequent. Therefore, genes and metabolism of contemporary pro-cyclists might be changing.

References