The 1-s interpolation of breath-by-breath O2 uptake data to determine kinetic parameters: the misleading procedure

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Dear Editor-in-Chief,

Zignoli et al. [3] have recently published a thorough paper concerning the state of the art concepts and future directions in modelling oxygen consumption in cycling exercise. Among the "Limitations of the hand-written models", the authors quote one of our papers [1], attributing to us a concept that had never been expressed in the cited paper and that is exactly the contrary of what is stated in the paper.

As discussed in detail in our paper [1], the accuracy of the parameters estimated applying the non-linear regression procedure is not affected by whatever data treatment is applied (from nothing to the resampling and/or the averaging of more repetitions). Conversely, the confidence interval (CI) of the parameter

estimates are sensible to the applied data treatment. In particular, by interpolating the oxygen uptake data at 1-s for kinetic analysis, no improvement of the parameter CI is obtained, but rather the CI necessarily becomes *falsely* smaller compared to the correct one. This phenomenon is due to the fact that the interpolation procedure increases the number of data points, but the already available information is only reiterated in the added data points, without introducing new information. It can be easily demonstrated that a linear interpolation on a 0.01 s-by-0.01 s basis will result in a further narrowing, roughly by the factor $\sqrt{\frac{1\text{s}}{0.01\text{s}}} = 10$, of the CI [1]; following this reasoning, the narrowest CI would be obtained by interpolating the data on an infinitesimal-by-infinitesimal basis.

In the paper by Francescato et al. [1] we demonstrate through Monte Carlo simulations that an asymptotic CI close to the correct one is obtainable by resampling the responses at a time interval slightly longer than the average breath duration.

Narrower, but still correct, confidence intervals can be obtained only by increasing the original information used (i.e., increasing the number of repeated trials). The simplest method to assemble together the different trials is to append the responses one after the other (“stacking” of the repeated responses); this method allows obtaining accurate estimated parameters and congruent CI when the non-linear regression technique is applied [2].

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