J Appl Physiol 122: 1371–1372, 2017;
doi:10.1152/japplphysiol.00231.2017.

LETTER TO THE EDITOR

Reply to Drs. Van Breda et al.

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Submitted 15 March 2017; accepted in final form 20 March 2017

TO THE EDITOR: We thank Drs. Van Breda et al. (7) for their interest in our recent CORP article (6). Although we appreciate the substantial challenges inherent with making maximal exercise measurements in the clinical setting, we assure them that there is nothing remotely "fragile" regarding our criticisms of the use and misuse of $\dot{V}O_{2peak}$ as a $\dot{V}O_{2max}$ surrogate. Indeed, on this and each criticism they raise there have been misconceptions and missed perceptions:

1) Criticism: "*there is no reference to . . . parameters . . . identified . . . . prior to* $\dot{V}O_{2max}$." We state explicitly (7): "*Used correctly the incremental/ramp test can appraise four sentinel parameters of aerobic function: the gas exchange threshold, exercise efficiency (i.e.,* $\dot{V}O_2$*-work rate slope in ml·min*$^{-1}$·*W*$^{-1}$ *for cycling),* $\dot{V}O_2$ *kinetics (i.e., time constant,* τ*), and potentially* $\dot{V}O_{2max}$".
2) Criticism: "*the highest* $\dot{V}O_2$ *reached during a test, whether or not being a true* $\dot{V}O_{2max}$*, is of major clinical importance . . .*" If it is not $\dot{V}O_{2max}$ then it is not a measurement of the upper capacity of the O_2 transport system and should not be taken as such without appropriate qualification.
3) Criticism: "*the authors used technological progress in indirect calorimetry as one of the most important factors for waiving the concept of* $\dot{V}O_{2max}$*.*" Absolutely not true. We said: "*interest in developing shorter continuous-type tests . . . concomitant with the advent of rapidly-responding* O_2 *and* CO_2 *analyzers . . . the maximal incremental or ramp testing protocol became popular.* "This is a statement of fact not opinion.
4) Criticism: "*We . . . showed that mixing chamber systems have better accuracy and precision than breath-by-breath systems . . .*" Ignoratio elenchi! The accuracy of mixing-chamber systems vs. breath-to-breath was not raised. However, breath-to-breath systems can provide a fidelity and sensitivity far greater than their mixing-chamber counterparts.
5) Criticism: "*we believe ("that the 'short constant-work rate verification phase' after the steep-ramp test") is . . . unrealistic and unethical in certain patient populations . . .* " There is no disagreement that the health and safety of the patient must come first. However, repeated bouts of severe-intensity exercise (so-called HIIT) are well-tolerated by even severely compromised patient populations (1, 2, 4, 5). Indeed, one suspects that this has been known at least since the noted physician William Heberden's observations in his heart failure patient in the late 1700s (reviewed in Ref. 8).
6) Criticism: "*in patient populations you have to accept that the day-to-day (patho)physiological variation caused by non-physiological elements is 'part of the deal'*." This specific issue was not raised in the CORP under scrutiny. Of course, without correct measurement of $\dot{V}O_{2max}$, Van Breda et al. (7) could not discern what was day-to-day variation vs. measurement error: a not inconsequential consideration for determination of efficacy in patient rehabilitation. This reasoning epitomizes why we are strong proponents of scientific rigor in $\dot{V}O_{2max}$.

The purpose of the CORP is specifically to address the problems of lack of reproducibility across and within scientific investigations. This is a central mandate from the National Institutes of Health, and others, to the scientific community. Without rigorous approaches to experimental design and measurements it is difficult, if not impossible, to discriminate data from dogma. Indeed, pursuant to the $\dot{V}O_{2max}$ issue herein, reports that exercise training supposedly decreases $\dot{V}O_{2max}$ in select individuals (personal communication) or increases maximal heart rate at $\dot{V}O_{2max}$ (3) would have been more credible had rigorous criteria for $\dot{V}O_{2max}$ been instituted as recommended in the Poole and Jones CORP.

AUTHOR CONTRIBUTIONS

D.C.P. and A.M.J. conceived and designed research; D.C.P. and A.M.J. drafted manuscript; D.C.P. and A.M.J. edited and revised manuscript; D.C.P. and A.M.J. approved final version of manuscript.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

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