

Letter to the Editors

Recovery test results as a prerequisite for publication of gaseous exchange measurements

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In the last decade, various applications of gaseous exchange measurements have been developed for quantifying the production or consumption of particular gases. Notably, booming research into methane emissions has led to an expansion of the number of facilities in which such measurements can be performed. Recent research by Gardiner *et al.* (2015) has confirmed our concern that not all research groups comply with the same standards, and it is alarming to read full system recoveries of six facilities in the UK, to be varying between 59% and 115% (six facilities, 22 individual chambers measured). We are convinced that such unacceptable recoveries also occur elsewhere. From two courses on indirect calorimetry that we organised, directly following the ISEP conferences in Davis in 2013 (USA) and Krakow in 2016 (Poland) we learnt that recovery tests are not consistently performed around the world. The urge for performing such tests has also recently been emphasized by Hammond *et al.* (2016).

We are of the opinion that for all techniques aiming at quantification of gas exchange or production, either indirect calorimetry, methane emissions by chamber technique, ventilated hood or head box techniques, full system recovery tests of the relevant gas should be performed immediately before or following the measurements that are reported, and the results of these recovery tests for each chamber or unit are reported in the 'Material and methods' section of the manuscript. Currently, results of recovery tests are rarely reported. Procedures for recovery tests are fairly simple and can easily be found in references included below.

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References

- Gardiner TD, Coleman MD, Innocenti F, Tompkins J, Connor A, Garnsworthy PC, Moorby JM, Reynolds CK, Waterhouse A and Wills D 2015. Determination of the absolute accuracy of UK chamber facilities used in measuring methane emissions from livestock. *Measurement* 66, 272–279.
- Hammond KJ, Crompton LA, Bannink A, Dijkstra J, Yáñez-Ruiz DR, O'Kiely P, Kebreab E, Eugène MA, Yu Z, Shingfield KJ, Schwarm A, Hristov AN and Reynolds CK 2016. Review of current *in vivo* measurement techniques for quantifying enteric methane emission from ruminants. *Animal Feed Science and Technology* 219, 13–30.

Reference books for Calorimetry, including detailed description of recovery tests

- Gerrits WJJ and Labussière E 2015. Indirect calorimetry, techniques, computations and applications. Wageningen Academic Publishers, Wageningen, The Netherlands.
- McLean JA and Tobin G 1988. Animal and human calorimetry. University Press, Cambridge, UK.