Peer Community In
Animal Science

Accurate predictions of chemical composition of pigs for a wide range of body weights: no longer a myth!

Florence Gondret based on reviews by Mathieu Monziols and 1 anonymous reviewer

Open Access

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A recommendation of:

Claudia Kasper, Patrick Schlegel, Isabel Ruiz-Ascacibar, Peter Stoll, Giuseppe Bee. **Accuracy of predicting chemical body composition of growing pigs using dual-energy X-ray absorptiometry** *(2020), bioRxiv 2020.09.15.286153, ver. 4 peer-reviewed and recommended by PCI Animal Science.*

10.1101/2020.09.15.286153

Submitted: 17 September 2020, Recommended: 13 December 2020

Cite this recommendation as:

Florence Gondret (2020) Accurate predictions of chemical composition of pigs for a wide range of body weights: no longer a myth! . Peer Community in Animal Science, 100005. 10.24072/pci.animsci.100005

Assessing body or carcass composition in growing pigs is essential to refine nutritional models, select for specific traits and evaluate pork products. The gold standard methods are dissection and chemical measurements, which are time-consuming and invasive ways to obtain the data. Different teams have tested dual-energy x-ray absorptiometry (DEXA), especially for determining total and regional body composition of fat, soft lean tissues and bone minerals [1-3]. The DEXA measurements are quick, non-invasive, precise, and operator independent. However, the

instruments from different manufacturers are unique in implementation so that it is difficult to obtain and share generalized equations. In addition, the validity and accuracy of the measures when applied to pigs having very different composition have been scarcely addressed.

The present manuscript shows that carcass analysis by DEXA can be used to predict empty body chemical composition, and it provides accuracy values for the content in single nutrients (protein, lipids, Ca, P). The body weight range used to generate differences in body composition is very large (20 to 100 kg), which is important when studying pigs along growth. Moreover, regression equations within weight classes (20, 60 and 100 kg) show no important biases, with the exception for body fat especially at the earliest growth stages. Limitations of the technique are the needs of anesthesia when applied to living pigs, and of standardizing the positions of body, carcass and cuts when applied to living or dissected pigs. Another originality of the manuscript is the comparison of the obtained calibrations with previously published prediction models, showing that the differences do not preclude the possibility to use a single model when built from a meta-analysis of the different data. Taken together, this work offers good perspectives to refine nutritional models by inputs from rapidly analyzed body chemical composition and to monitor body and carcass composition in several pigs for genetics applications.

References

[1] Mitchell AD., Scholz AM., Pursel VG., and Evock-Clover CM. (1998). Composition analysis of pork carcasses by dual-energy x-ray absorptiometry. Journal of Animal Science. 76(8), 2104-14. https://doi.org/10.2527/1998.7682104x

[2] Marcoux M., Bernier JF., and Pomar C. (2003). Estimation of Canadian and European lean yields and composition of pig carcasses by dual-energy X-ray absorptiometry. Meat Science. 63(3), 359-65. https://doi.org/10.1016/S0309-1740(02)00094-3

[3] Kipper M., Marcoux M., Andretta I., and Pomar C. (2018). Repeatability and reproducibility of measurements obtained by dual-energy X-ray absorptiometry on pig carcasses. Journal of Animal Science, 96(5), 2027-2037. https://doi.org/10.1093/jas/skx046 "

Revision round #2

2020-12-10

Dear authors, After the careful reading of this second version of the manuscript, I think that Rewiewers' comments have been properly addressed in this revised version of the preprint. However, I still have some comments that must be addressed before I can render a decision and recommend the preprint. Comments are listed below.

I hope that you will be able to make the modifications and provide a clean version incorporating the modifications (without any track changed), so that the process could continue to its term.

I thank you for choosing PCI in Animal Science in order to give a large exposure to your work and to support Open Science.

Florence Gondret

Minor comments:

- Section L20-L29 should be shortened, since here this sounds as a repetition of the introduction section.
- L33 "we present the accuracy of those predictions". please give details about the accuracy obtained for a subset of studied traits. This will be more informative for the readers.
- L34: provide the values used to estimate the accuracy (RMSE, etc.)
- L35-36: "This should be deleted, since the conclusion of the abstract already states this.
- L55: delete unappropriated bracket
- L132: spell the abbreviation EB
- L485: verb and words are missing in the sentence (fits well ?)
- L614: provide a reference number or link in Zenodo, so that data could be easily found by the readers

Preprint DOI: https://doi.org/10.1101/2020.09.15.286153

Author's reply:

Dear Dr Gondret,

thank you very much for your feedback. I changed the manuscript according to your suggestions and I uploaded the new version.

Thank you for your efforts on behalf of the manuscript!

Kind regards,

Claudia Kasper

Revision round #1

2020-11-05

Dear authors,

The manuscript quoted in reference has been examined by two expert scientists in body composition evaluation in pigs. Although the two reviewers found merit in this study and recognized the quality of the associated paper, they raised a number of concerns that should be addressed before any decision could be rendered. I enclosed below detailed evaluation points. If you think you are able to provide a detailed answer to the different points, I encourage you to respond point by point and submit a new version of the preprint.

Anyway, thanks you for submission to PCI Animal Science Community.

Best regards,

Florence Gondret

Preprint DOI: https://doi.org/10.1101/2020.09.15.286153

Reviewed by Mathieu Monziols, 2020-11-05 15:26

General comments. This paper presents the potential of Dual X-ray absorptiometry to predict chemical composition of living pigs. Evenif there are already papers on the subject showing that DXA is a suitable methods to predict chemical composition, this paper is clearly original because it shows the absolute need of DXA calibration in order to obtain accurate prediction and also shows that carcass analysis can be used for empty body chemical composition (with an increase in the prediction error). Furthermore, another originality is the comparison with already published prediction models and the differences observed. That is suggesting the possibility to use a single model for closed DXA systems which is quite interesting.

The paper is well written, clear and very understandable. The figures are also clear and support the text.

The paper can be published with few minor revisions

Form modifications :
- Line 55 : It is the first line where the different chemical measurements are presented. It would have been kind for a non chemical composition measurements initiate reader to have the full name of the different terms as for example : Bone minerals (ash), total Calcium (Ca), total Phosphorus (P), Total Crude proteins (CP), total nitrogen (N) and total lipids (lipid)

- Line 56 : same remark for body weight (BW)
- Line 56 : same remark for Empty body (EB)
- Table 1 : the EBW-3 /carcass weight variable can be understood as a ratio which is not, maybe it can be changed by total mass (EBW-3 or carcass)
- Table 3 : RMSE is expressed in the same unit as the predicted variable, I suggest to add the units of the variable for the RMSE

Minor remark for paper improvement : As stated in the paper, the bw range used for a predictive regression model calculation is extremely important. But there is no mention in the paper of specific regression models for each BW groups used in the global trial. It would have been interesting to have a quick remark on the different models (intercepts and slopes) obtained at within different target body weight groups (20, 60 and 100) to ensure the relationships between chemical measurements and DXA are closed to the global one (and that the global one is indeed linear). Even if the 20 kg and 60 kg groups are composed of 6 and 18 individuals respectively, it would be interesting to have a word in the paper about such intra bw groups models and if their prediction results would differ from the global model ones.

Reviewed by anonymous reviewer, 2020-09-30 09:30

Please note that during the download process, I was not able to get the supplemental material.

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Author's reply:

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