



Peer Community In Animal Science

Towards a better optimization of the genetic improvement of chicken breeds: Introduction of simple phenotypic traits related to body composition for easy measurement in the selection programs of laying hens.

Seyed Abbas Rafat  based on peer reviews by 2 anonymous reviewers

Nicolas Bédère, Joëlle Dupont, Yannick Baumard, Christophe Staub, David Gourichon, Frédéric Elleboudt, Pascale Le Roy, Tatiana Zerjal (2023) Genetic background of body reserves in laying hens through backfat thickness phenotyping. HAL, ver. 3, peer-reviewed and recommended by Peer Community in Animal Science.

<https://hal.inrae.fr/hal-04172576>

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In genetic selection, simplistic model of single-trait selection is usually considered, and the response to such approach is estimated using simple models. In practice, however, plant and animal breeders always deal with the selection of several traits, hence making the selection process very complex. Therefore, the simultaneous genetic improvement of several traits has always been one of the goals of livestock, including poultry breeding (Falconer, 1972). Studies that examine the indirect effects of selection on economic traits are eagerly awaited. In this context, the results of the study by Bédère et al., (2023) gives new insights about phenotypic and genotypic relationships between body reserves traits in laying hens. The authors aimed to propose novel data about the genetic architecture of traits related to body fat by measuring a series of phenotypic traits with relatively an easy approach. The authors further aimed to test and validate the phenotyping of backfat thickness as an indicator of the overall fatness of laying hens. Thus, the study allowed providing new evidence regarding the genetic determination of the backfat trait in chicken breeds.

The authors first estimated the effect of selection on the residual feed intake (trait x) on the trait of body reserves (trait y). In fact, divergent selection experiments are a fundamental research tool that allow revealing significant amount of data related to the possible span of genetic improvement for traits of interest. Consequently, by analyzing data from a divergent selection experiment, associations have been estimated between a number of feed-dependent traits that have practical use for chicken breeders. Estimation of the correlations between traits is under question in terms of the theory of genetics and their application in multi-trait selection. As a major finding of the study, the observation of a bimodal distribution of backfat in both lines and the heterogeneity of the variances between families allowed suggesting a possible major gene, which could be investigated in future studies using for instance quantitative genetics. Body composition is continually studied in broilers chicken, but this aspect of chicken genetic is more detailed in laying hens.

The current findings are worthy to validate using several approaches. In fact, one of the limitations of the study can be related to other statistical models that can be built. For example, the study revealed high correlations between egg production and body weight, thus body weight could be considered as a covariate in regression models. Moreover, the principal trait of selection (based on the residual feed intake) could be considered.

References:

- Falconer, D. S. (1972). Introduction to Quantitative Genetics. Publisher: Ronald Press Company. pp 365.
- Bédère, N., Dupont, J., Baumard, Y., Staub, C., Gourichon, D., Elleboudt, F., Le Roy, P., Zerjal, T. (2023). Genetic background of body reserves in laying hens through backfat thickness phenotyping. HAL ver. 3 peer-reviewed and recommended by Peer Community in Animal Science.
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Reviews

Evaluation round #2

DOI or URL of the preprint: <https://hal.inrae.fr/hal-04172576>

Version of the preprint: 2

Authors' reply, 11 December 2023

Dear Dr Rafat,

Thank you for considering our paper for recommendation.

The data has been published and is available here: <https://doi.org/10.57745/HUQOXW>

We changed the manuscript to mention this link.

Here are our answers to your final questions:

- + L73 OK, we changed Mellouk et al. (2018) to (2018a) or (2018b) throughout the manuscript
- + L129 OK, we changed TotFat to CT-TotFat throughout the manuscript
- + L244 OK, we corrected the spelling of Pearson.
- + L251 In Mellouk et al. (2018b), both traits were recorded: lipid content of the shredded body and CT-scan lipid volume estimate. In the discussion, where the comment is located (L251), we refer to the correlation between backfat and the lipid content of the shredded body, with a value of 0.92; and we refer to the correlation between backfat and the abdominal fat pad weight, with a value of 0.86.
- + L257 It is the mean of the standard errors estimated in the various bivariate analyses. We edited L194 in the Material and Methods to make this point clear.

Best regards,
Nicolas Bédère

Decision by Seyed Abbas Rafat , posted 07 December 2023, validated 07 December 2023

Minor suggestions

Dear authors

The recommender of your paper is about to recommend your manuscript. He requested to address final comments that you will find enclosed in the annotated pdf.

Please let us know once you upload the revised version in the preprint server to proceed with the validation of the recommendation.

Thanks for your contribution to PCI Animal Science.

Best regards.

The managing board [Download recommender's annotations](#)

Evaluation round #1

DOI or URL of the preprint: <https://hal.inrae.fr/hal-04172576>

Version of the preprint: 1

Authors' reply, 07 December 2023

[Download author's reply](#)

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Decision by Seyed Abbas Rafat , posted 23 October 2023, validated 23 October 2023

Revision Request

Dear Dr. Nicolas Bédère,

Bonjour,

Thank you for submitting a manuscript to PCI Animal Science.

Manuscript entitled "Genetic background of body reserves in laying hens through backfat thickness phenotyping" which you submitted to PCI Animal Science has been reviewed.

Sorry for the late reply. I would like inform you several reviewers were assigned to your manuscript and the reviewing process was a little long. But, we received comments of two reviewers, they acknowledged that your manuscript had valuable results. The reviewers highlighted a number of issues with the manuscript that need to be addressed before the paper can be considered for publication.

I look forward to receiving your revision.

Cordialement,

S A Rafat

Reviewed by anonymous reviewer 2, 25 September 2023

This study aimed at validating backfat thickness as an indicator of fatness in laying hens, estimated its genetic parameters, and examine its relationships with other traits. Overall, this study provided useful information that is of potential interest to egg layer breeders and researchers. My main concern is that an indirect measurement of fatness (CT scan) rather than a more direct measurement (such as abdominal and mesenteric fat weight or chemical analysis) was used to validate the backfat thickness method. So, I would recommend being less assertive with the conclusion, as suggested below (L325)

Comments/suggestions/questions:

L35: "extend the career of laying hens" should be reworded, as "career" is typically used in reference to people, and its use for layer hens is uncommon.

L41: Usage of "..." is uncommon in the scientific literature. Please consider removing these throughout the text. For example, you could use "such as x, y and z" to indicate that there are more items than x, y and z.

L110: change "soon after death" to "immediately after euthanasia"

L115: "Fatty components were located between -130 and -90 HU." Was this established based on prior studies? If so, please provide citations. If the answer is no, please provide explanation as to how this has been established. Some readers like myself may not be familiar with this technique.

L134-135: "A first blood sample was collected from the wing vein at 17 weeks of age and a second blood sample was collected during the neck bleeding at the slaughter process, at 53 weeks of age" since blood from neck bleeding contains a mix of arterial and venous blood, as oppose to blood samples collected from the wing vein, do the authors expect no impact of blood source on the levels of compounds measured in this study?

L187-190: this sentence is difficult to understand; it could be revised and split to shorter sentences

L185: "Descriptive statistics of the data suggested a bimodal distribution of backfat." Was this observed within both R- and R+ lines, or just within one of these lines?

L186: change "Reported heritabilities" to "Reported heritability estimates"

L237: change "consistent with the findings previously" to "consistent with the findings previously"

L268: change "latter alining with" to "latter aligning with"

L283: change "inlucence in our setup" to "influence in our setup"

L315: change "few studies mentionning" to "few studies mentioning"

L318: change "a targetted neither" to "a targeted neither"

L325: change "backfat thickness is an accurate indicator of the overall fatness of laying hens" to "backfat thickness is a potentially accurate indicator of the overall fatness of laying hens"

Reviewed by anonymous reviewer 1, 28 September 2023

Review on: Genetic background of body reserves in laying hens through backfat thickness phenotyping

General comments:

The overall purpose of the manuscript is to investigate backfat thickness phenotyping and investigating its heritability and relation to phenotypes in laying hens. This is a well-prepared manuscript and carefully prepared and carried out in opinion of the reviewer. Overall, the authors highlight the potential to utilize backfat thickness for additional genetic information, but given that the association was "moderate and negative", the authors

could potentially shift the discussion to show how backfat thickness could serve as a “more\less/easier/harder” efficient technique to drive selection? The materials and methods section can be improved for repeatability of the research work being presented. Overall a well written and thoroughly cared for manuscript.

Need better table descriptions so they are standalone items for text

Specific comments:

Lines 46-52: what are the nutritional effects/confounding effects and how could it be adjusted to deal with these issues, is this a management issue or a reality across all production systems?

Lines 60-62: Aren't these techniques developed through time-point slaughter through different slaughter points in different physiological stages? Perhaps making the argument differently could avoid this confusion, but allometric sequential slaughter studies are a good way to determine dynamics of body reserves.

Lines 79-81: citing of ideal physiological body conditions from literature

Lines 101-103: more details on facilities, diet, operations would allow for reproducibility

Lines 101-105: Would suggest creating a table with the diets for the animals, also need more details on housing of the animals and feeding management for reproducibility

Line 113: recommend “hens were placed dorsally on the x-ray”

Line 137-140: Why were blood samples collected from different locations, would adipokine concentration be distributed in similar concentrations in both tissues?

Table 1. Standardize decimal places for all values reported

Line 212: Fort “For” ?

Line 214: “performed on one batch only”, also can this be fixed with additional sample analyses?

Line 221: “leaner”

Line 235-237: need to cite the papers you are referring to

Line 238: The reviewer would suggest the need to establish and justify highly, and moderately, different fields will have different thresholds on what is a good/high correlation value, list results and p values.

Lines 281-283: would ghrelin and adipokine levels shift at different physiological stages? Is the association linear or are there allometric coefficients attributable to different life stages? Diet/management effect on these markers is overlooked if not discussed further, would you believe this could influence the results you observed?

Line 308 and throughout: the reviewer would suggest not starting sentences with abbreviations.

