



Peer Community In Animal Science

Understanding milk and body reserves trajectories and nutrient partitioning in dairy goats through a modelling approach

Alberto Atzori based on peer reviews by **Kristan Reed** and 2 anonymous reviewers

Nicolas Gafsi, Olivier Martin, Fabrice Bidan, Bénédicte Grimard, Laurence Puillet (2024) Diversity of performance patterns in dairy goats: multi-scale analysis of the lactation curves of milk yield, body condition score and body weight. Zenodo, ver. 3, peer-reviewed and recommended by Peer Community in Animal Science.

<https://doi.org/10.5281/zenodo.10101318>

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The dairy sector is facing an historical period of high milk demand. However, increasing feed prices continually reduces the economic margins for farms. Managerial strategies to increase economical and technical awareness of animal performance, support the decision chain and optimize the use of production inputs are increasingly necessary, especially in goat farms with intensive production systems. Among the scientific goals, there is a particular emphasis on increasing knowledge about nutrition partitioning between milk production and body reserves — a topic that not easily addressed by nutritional models, limiting the attempts at production forecasting.

The paper by Gafsi et al (2024) presents an interesting approach to studying phenotypic traits and trajectories of goat performance. It assesses the diversity of phenotypic trajectories reflecting functions such as milk production, body weight and condition score. This approaches aims to describe, understand and explore the interactions among biological functions and potential trade-offs of phenotypic trajectories across current and successive lactations. The work significantly contributes to the literature, particularly because previous descriptions of lactation curves relied primarily on mathematical outputs lacking information about the relationship among physiologically related variables.

The analysis retrieved data from about 1500 goats over more than 20 years and was conducted with a multiscale approach. Data were fitted considering different types of models, including description of perturbations for lactation curves and with multiphasic models for the body weight and body condition score.

Synthetic indicators were then estimated with a multivariate approach to define fitted trajectories and changes in performance.

The association among performance directly refers to nutrient partitioning, and the adaptive response of individual animals refers to nutrient availability and their aptitude to direct the metabolic effort toward milk production. In fact, the research shows that trajectories from the first lactation were often maintained in sequent ones. Positive associations among milk curve perturbations and the individual aptitude to drive nutrients to body reserves were also observed.

The multiscale approach developed in the paper may provide original insights both for describing animal performance and for ranking individual animals within farm groups. Practically, the method could inform the development of algorithms to support culling policies and individual animal assessments. Additionally, the data are available to the scientific community for further research and applications.

I recommend this paper as a methodological example with high replicable approaches for both goats and other dairy species, with significant applicative opportunities at the farm level.

References:

Gafsi N, Martin O, Bidan F, Grimard B, Puillet L (2024) Diversity of performance patterns in dairy goats: multi-scale analysis of the lactation curves of milk yield, body condition score and body weight. Zenodo. 10101318. ver.3 peer-reviewed and recommended by Peer Community In Animal Science.
<https://doi.org/10.5281/zenodo.10101318>

Reviews

Evaluation round #1

DOI or URL of the preprint: <https://doi.org/10.5281/zenodo.10101319>

Version of the preprint: 1

Authors' reply, 02 April 2024

Dear Recommender,

Please find here enclosed our revised version of the manuscript "Diversity of performance patterns in dairy goats: multi-scale analysis of the lactation curves of milk yield, body condition score and body weight " for recommendation in Peer Community in Animal Science. We are grateful to the reviewers for their interesting suggestions that helped us to improve the readability and the quality of our manuscript.

As suggested by the reviewers, we revised our manuscript to clarify English aspects, some terminology used, and improve some elements in the methods and discussion sections. We hope that the revised version of our manuscript will be acceptable for recommendation. All authors have approved the revised manuscript

Sincerely,

Nicolas GAFSI

[Download author's reply](#)

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Decision by **Alberto Atzori**, posted 14 March 2024, validated 14 March 2024

The paper is original and presents an interesting approach to studying phenotypic trends and trajectories of goat performances, focusing on milk production, body weight, and condition score. The work significantly contributes to the literature, particularly as previous descriptions of lactation curves relied primarily on mathematical outputs lacking information about the relationship among physiologically related variables. The multiscale approach developed in the paper provides original insights and useful methodological developments. Methodologically, the paper is sound and well-executed. The objectives are clearly defined, the methods are detailed, and the results and discussions are exhaustively presented, supplemented with graphical material. Additionally, data are available. Reviewers have provided several suggestions to improve the paper including the need for English editing, clarification of terms and methodological aspects, and integration of literature references in the results and discussion sections. I invite the authors to address the comments of the reviewers in a new version.

Alberto Atzori

Comments from the managing board

- In the conflict of interest disclosure, please clarify that Laurence Puillet is recommender of PCI Animal Science.
- Please add information on ethics approval to animal experimentation. Authors must provide information about the compliance of their work with ethical standards of their national ethical committees and report the reference number of the ethical committee approval. If the study did not require ethical approval, authors should include some sentences explaining why the approval was not needed.

Reviewed by **Kristan Reed**, 16 February 2024

The manuscript presents a very interesting and novel approach to using time-series data on milk yield and body-weight measurements from dairy goats to group animals into different categories based on their energetic partitioning.

I believe this work will be a valuable contribution to the literature and would like to spend more time reading and reviewing it. However, given the current constraints on my time I can only offer a partial review and hope the feedback I have at this point will be useful and that we can continue the conversation in the future. I also hope that the authors might be able to make some changes that would help improve the clarity of the manuscript for myself and future readers.

I have attached a PDF with some specific comments but here are couple of general comments/suggestions:

- I think the methodology section would benefit from moving some of the details of the data collection, and curve fitting to an appendix or supplementary material and more description of the clustering, PCA methods, and how the authors used that information to achieve their objectives. My understanding at this point is that it is those two methods for distilling the information and grouping animals into clusters or profiles followed by how the authors analyzed the results of those clusters that allowed the authors to get to results like those in Figures 7-9. However, these methods are not well described.
- I suggest considering changing the use of the term 'trajectory'. This word includes an aspect of forward movement and implies an analysis of what will happen in the future. However, as I understand it at this point, this is a retrospective analysis of the correlations between the patterns in different performance metrics as summarized by lactation and growth curves. Perhaps something as simple as 'patterns' or 'behaviors' would be a better choice for this analysis since you are not predicting what will happen to animals in the future.

[Download the review](#)

Reviewed by anonymous reviewer 1, 17 February 2024

Diversity of performance patterns in dairy goats: multi-scale analysis of milk yield, body condition score and body weight trajectories

GENERAL COMMENTS

Interesting and original paper on the multi scale analysis of productive trajectory of goats, with many interesting insights and innovative approaches to explore the topic.

The English requires a substantial revision. Common problem regards the syntax, with unproper subjects or construction of the sentence, erratic commas and parenthesis. I will give a non-exhaustive list in the specific comments.

There is not information of the prolificacy of the animals, which might have affected all trajectories studies. This information should be considered for each single animal studied, considering that goats can have very high prolificacy. Also, milk fat was not considered (maybe not available), making MY less accurate than could be

There is not information on the type of diets used in the two farms. Did they allow individual adaptation of intake to requirements, as it occurs in TMR diets not too rich in NDF? Were concentrates (some or all) supplied in equal doses at milking, for lactating animals? How was the nutritional level set? By group? Were the diets different between primiparous and pluriparous? Where these categories physically separated or kept together in the same pen?

All the abbreviations regarding the synthetic indicators reported in tables 3 to 6 (e.g. YPI-3..) should be listed in an initial table with a brief description of their meaning. It is hard to follow the text with all those abbreviations.

The discussion is kind of weak regarding the reasons that caused disconnected trajectories (see comments for L 893-395 and L 913-921)

SPECIFIC COMMENTS

L37: comma after goats

L57: Not only the French sector...

L57: comma after challenges.

L95 : "were used" should go in line 96 after 2003)

L97: Here and in the rest of the paper: why do you put a comma before the parenthesis when citing a paper? cut the comma before parenthesis

L107: why recent? Do we have old studies similar to yours? If yes, why there are not valuable?

L119: no information on prolificacy of the goats and diets used in the two farms.

Any general climatic difference among the two farms

L 209, 2013, 225: cut the commas, see comment for L97. I will not write this anymore, but there are many citations like this in the whole paper

L 249: why did you put the names within parenthesis and not only the year? Does not make sense

L 312: VS is an abbreviation, it should have a dot "VS." Put a comma after WEIGHT

L320 BY THE two phenotypic clusters. Which type of clusters, do you mean primiparous and multiparous? WERE, not ARE

L321 WAS associated

L329 comma after association

L 517: three clusters is repeated twice

L 612: BETWEEN is a comparison of 2 things, among of more than two things. Use AMONG here and in the rest of the text when needed (most of the cases in your paper)

L822, 823; comma after parenthesis

L827. Comma after CORRELATED

L829: I would put AND instead of THEY

L830. Comma after PROFILE

L850: comma after KG

L857 cut FOR

L858: put comma before PRIMIPAROUS, put a comma before WHILE. I will stop correction commas, too many wrong ones, but remember that before whereas, while, which is usually needed. Also, many other commas are wrong or, more frequently, missing.

L866 THEY need to be..

L868: why comma before Sauvant? The sentence is interrupted after BY?

L 878 THOSE for sternal..

L879 cite the French feeding system. Which version?

Line 881, 883 DID NOT PLAY

L893-895: it might also suggest great diversity in intake (and thus in feed efficiency) more than in energy partitioning, or differences depending on the numbers of kids per parturition. It is also possible that the indicators you considered were not accurate enough to detect consistent patterns. For example, we know that BCS in goats is not very accurate, precise, and repeatable, being a subjective method. In addition, goats accumulate a lot of visceral fat when in positive energy balance, and this is difficult to detect by using BCS, which tend to level off even though body fat keeps accumulating

L895 cut ASSESSING . Associations AMONG...WERE...

L 902: you should explain/describes the four trade-offs, otherwise the citation is useless

L909 you should motivate more clearly this point. E.g. could be a problem of diet quality that limited intake in some animals?

L913-921: not clear to me. Adaptive capacity does not imply that milk yield, BW, and BCS score trajectories are disconnected. In addition, even at individual level the energy balance cannot skip the rule of energetics. Thus, unless measurements are inaccurate (see comments above for BCS; in addition, milk fat might vary a lot at equal MY), trajectories must be connected. Of course, you do not know individual intake, and this might partially explain the disconnection

L925 . primiparous GOATS

L 937 ..speed, so THEY were..

L949 : why you did not consider litter size in your study?

L967 IT RAISED A QUESTION... awkward sentence, not coordinated with the rest of the sentence

L 191-982 awkward sentence

L1015 AMONG goats

L1099 ????

Reviewed by anonymous reviewer 2, 21 January 2024

Comments

The topic of this paper (Diversity of performance models in dairy goats: multiscale analysis of milk production, body condition score and body weight trajectories) is very interesting and with a rather innovative modeling approach to evaluating recordings as milk yield, body weight and body condition score. The dataset on which the study is based is relevant, especially as regards the goat species.

This work analyzes the variability of the curves of milk yield, of body weight, and of body condition score (BCS) of Alpine and Saanen goats during their lifetime, firstly by characterizing their individual curves, then exploring how the different curves of milk yield, body weight, and body condition score are associated between them during the same lactation, and finally assessing the shape of the different curves on successive lactations.

The abstract starts pointing out that “in the French dairy goat sector, low longevity is a key issue leading to higher replacement rate in the herd and poor dilution of does rearing costs. There is a need to better understand determinants of lifetime performance”. However, it must be considered that the dataset, although very large, derives from the routine recordings of the variables considered in the study of only two farm realities. This could be seen as a limit, but anyway it is a good starting point. The conclusions recognize that “further analysis are needed to include reproductive performance in analyzing lifetime performance profiles and better identify profiles or combinations of profiles at risk in terms of culling.” In the introduction it could be emphasize this aspect.

Specific comments

Title

Line 2: for the title I suggest to find another word for substituting “trajectories”. The classic term “curves” sounds better. In the whole manuscript “trajectory/ies” appears more than 130 times, therefore it is suggested to reduce this frequency by applying other terms like “curves”, for BW and BCS “changes”, or “dynamics”.

Key words

Line 41: It is suggested to change “milk yield trajectories” with “milk yield curves”.

Line 42: It is suggested to change “body condition score trajectories” with “body condition score changes”.

Introduction

Lines 76-77: the sentence “It is also is impaired (Friggens, 2003)” needs to be explain more clearly.

Material and methods

Lines 125-128, 136-137: the acronyms for MY, BW, BCS have already been specified, so they should be used.

Line 129: the cited paper of Morand-Fehr and Hervieu (1999) is missing in the references section.

Line 225: the cited paper of Grossman et al. (1999) is missing in the references section.

Line 232 (figure 2): it is suggested to add on the figure the annotation “plateau phase”.

Results

Line 358 (figure 4): it is suggested to change the colors of the clusters YpM- and YpH because it's easy to confound them.

Line 554, 556, 565, 573, 577, 591: it is suggested to change LUM+ with LUM (without +), and STM+ with STM, in accordance with the fact that the depletion is of medium intensity and not of high intensity. In accordance with this change, also the notes of the figure have to be modified.

Discussion

Lines 817, 825, 837, 898-900, 915, 918, 953, 981: the references (Gipson and Grossman, 1990; Safayi et al., 2010; Rupp et al., 2011; Waltner et al., 1993; Garnsworthy and Jones, 1987; Garnsworthy and Topps, 1982; Dumont et al., 2020, Inra, 2018; Puillet and Martin, 2017; Poppe et al., 2020) are missing in the references section.

Lines 819-821: It is suggested to give more details regarding the cited paper of Arnal et al. for a better comprehension.

Lines 878-879 (Our ... system): it is suggested to add a reference.

Lines 915-918 (On the ...Inra, 2018)): it is suggested to make this sentence clearer; furthermore, please note that the reference to Inra 2018 is missing in the references section.

References

Line 1099: this citation needs to be more precise.