Feed-a-Gene

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

Towards precision feeding in laying hens: Update of a mathematical model to predict daily calcium and phosphorus flows

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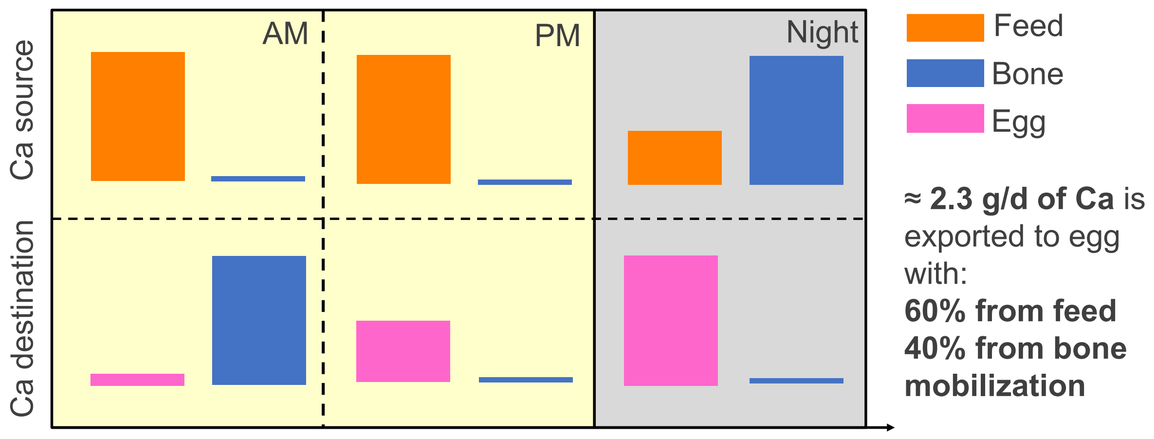
INTRODUCTION



Schematic overview of calcium (Ca) flows in laying hens within 24 hours

An intense and repeated mobilization / reconstitution of the medullary bone can lead to long-term and severe lesions affecting the animal's skeleton.

Precision feeding in laying hens by **providing an optimal calcium supply:**

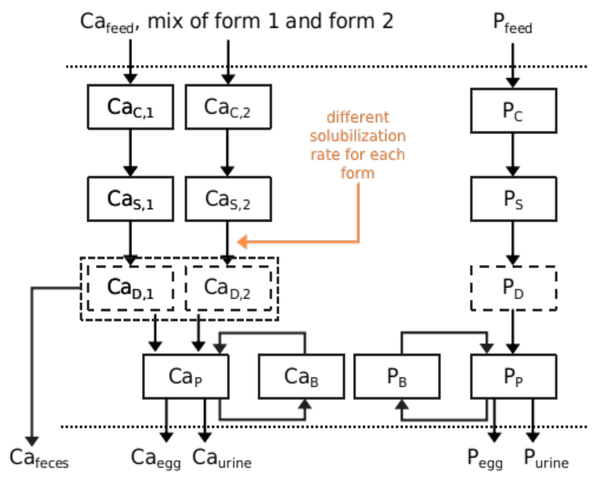
- Level
- Form
- Distribution kinetics

⇨

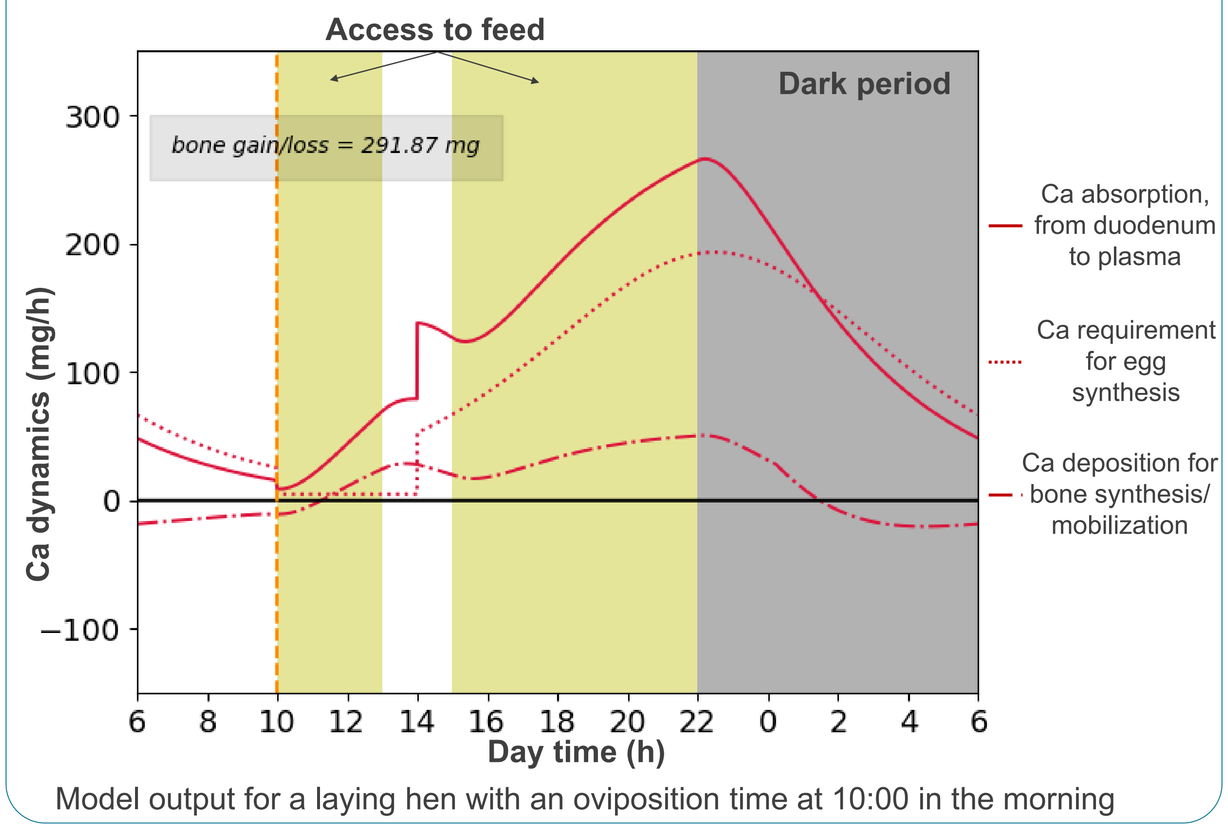
- Ensure **well-being**
- Ensure animal **longevity**
- Maintain **eggshell quality**

OBJECTIVES (model)

An existing **mathematical model describing calcium and phosphorus fluxes** in the animal [1] was adapted to better understand and predict calcium requirements:



Schematic representation of the mathematical model with two different calcium sources in feed

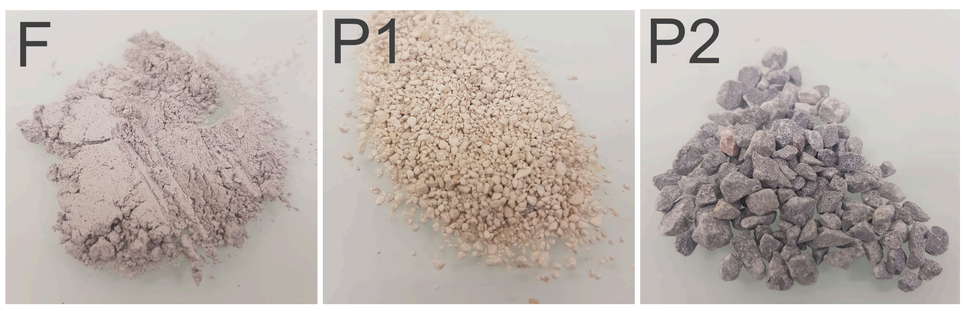


Model output for a laying hen with an oviposition time at 10:00 in the morning

OBJECTIVES (experimental validation)

An experimental trial involving 288 Lohmann Tradition laying hens from 19 to 33 weeks of age was conducted. Six different dietary treatments were tested (4 pens of 12 hens/treatment). Three different Ca sources were tested (flour F ; small particles P1 or large ones P2).

	T1	T2	T3	T4	T5	T6
Meal distribution	30% AM 70% PM	30% AM 70% PM	30% AM 70% PM	30% AM 70% PM	70% AM 30% PM	70% AM 30% PM
Calcium (%)	3,5%	3,5%	3,5%	3,5%	3,5%	3,5%
Form	70% P1 30% F	100% F	100% P1	100% P2	100% P1	100% P2



Three sampling series at 27, 30, and 33 weeks of age were performed to measure **ionic calcium** and **inorganic phosphorus** blood concentrations over 24 hours (3 to 6 samples per hen, 8 hens/treatment).

EXPECTED RESULTS

Calibration of the model (estimation of best parameters to fit experimental data) with measured calcium and phosphorus concentrations is still on-going.

After validation of the model simulating Ca and P flows for one given animal (oviposition time, body weight…), it could be implemented in **a new tool to identify the best feeding strategies at the flock level.**

REFERENCES

[1] Kebreab, E., France, J., Kwakkel, R. P., Leeson, S., Kuhi, H. D., & Dijkstra, J. (2009). Development and evaluation of a dynamic model of calcium and phosphorus flows in layers. *Poultry science*, *88*(3), 680-689.

ACKNOWLEDGMENTS / CONTACTS

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Feed-a-Gene

Feed-a-Gene is a European H2020 project involving 23 partners which aims to adapt feeds, animals and feeding techniques to improve the efficiency and sustainability of pig, poultry and rabbit production systems. It is coordinated by INRAE (France), started in March 2015 and will last 5 years. The project aims to reduce the environmental impact of monogastric livestock production by improving and diversifying animal diets and feed technologies and by integrating new selection criteria for these animals. The Feed-a-gene project further aims to develop new management systems for precision feeding and precision farming and to evaluate the overall sustainability of the different management solutions proposed in the project.

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