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Data paper

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ABSTRACT

A dataset of 100 pigs, from the Piétrain NN Français line raised at the AXIOM boar testing station in 2020, was used. The farm was equipped with an automatic feeding system, recording individual weight and feed intake at each visit. We used a dynamic linear regression model to characterise the evolution of the energetic allocation factor (α_t) which represents the link between the cumulative net energy available (estimated from feed intake) and cumulative weight gain during the fattening period. The data were imported using an R script to estimate the allocation factor for a given animal. The dataset and R script are useful resources to study feed intake, growth dynamics and the relationship between these two variables.

Specifications Table

Subject	Livestock Farming Systems
Specific subject area	BW and feed intake recorded on fattening pigs from approximately 35–107 kg BW.
Type of data	Table R script
How data were acquired	We collected data from the automatic feeding system (**AFS**) Nedap pig performance testing feeding station (Nedap N.V.; Groenlo, the Netherlands), recording weight and feed intake at eat visit.
Data format	Pretreated data in csv format (DataAxiom.csv)
Parameters for data collection	A total of 100 male pigs of Pietrain NN breed were randomly selected from the 990 animals raised in 2020 at the AXIOM boar testing station (Azay-sur-Indre, France) in pens of 14 pigs, each equipped with one AFS.
Description of data collection	Raw data were downloaded from Nedap Velos cloud in csv format file. They were pretreated to identify and remove outliers and to estimate missing values following the procedure described by Revilla et al. (2022). Data were aggregated from visit scale to daily scale.
Data source location	Company: AXIOM City: Azay-sur-Indre Country: France
Data accessibility	Repository name: zenodo Data identification number: https://doi.org/10.5281/zenodo.6626445
Related research article	Not applicable

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Value of the data

- Dynamic data of weight and feed intake from fattening pigs individually recorded at daily scale.
- Data are useful to estimate the allocation of energy intake to growth at day scale.
- The dataset and R script are useful resources to study feed intake, growth dynamics and the relationship between these two variables.
- The data are useful to develop models for characterising the response of animals in terms of the dynamics of feed intake and growth.

Data description

The data for the 100 fattening pigs are available at https://doi.org/10.5281/zenodo.6626445. They are stored in one csv file (DataAxiom.csv) and structured as follows.

- ID: pig identification number;
- Fattening_group.Pen: fattening group and pen number for a given ID;
- t: time in days since the transfer to fattening group;
- Wt: median weight in kg at day t for a given ID;
- FIt: total feed intake in kg at day t for a given ID.

The R script DLM_script.R includes the code with the implementation of the dynamic linear regression model for the estimation of the allocation factor.

Experimental design, materials and methods

Data collection

BW (kg) and feed intake (**FI** – kg) were recorded for 100 fattening pigs. The animals were entire male pigs from the Piétrain NN Français paternal line, free from halothane sensitivity, of the Axiom company. The animals were randomly selected from the 990 animals raised in 2020 at the AXIOM boar testing station and born on one farm. The animals entered the boar testing station after weaning at the rate of one group every 3 weeks and were raised in quarantine rooms and in postweaning rooms for 7 weeks. Then, they were transferred to fattening rooms (t = 0) when they were 76.5 ± 1.1 days of age (35.7 ± 5.8 kg BW). They were kept in fattening rooms, in pens of 14 pigs, during 71.8 ± 3.4 days until the individual candidate test at around 148.3 ± 3.4 days of age (107.2 ± 8.5 kg BW). During this period, animals were fed *ad-libitum* with a pelleted diet providing 9.85 MJ of net energy, 156 g of CP and 9 g of digestible lysine per kilogram of feed. This information was provided by the feed manufacturer (AGRIAL; Caen; France). Fattening pens were equipped with an automatic feeding system (AFS), the Nedap pig performance testing feeding station (Nedap N.V.; Groenlo, the Netherlands). BW (kg) and FI (kg) were recorded each time the animal went into the AFS.

Data pretreatment

Pretreatment was performed on data recorded by AFS at each visit using the procedure proposed by Revilla et al. (2022). The weight ($\mathbf{W_t}$ – kg) and the FI_t (kg) for each identified pig (**ID**) and each fattening day (t) were estimated, where t was time in days since the transfer to fattening room. Data recorded on day t = 0 were excluded from the dataset due to AFS calibration and animal adaptation. Missing values for weight and/or feed intake were also estimated using a local regression (Revilla et al., 2022). These data were included in the pretreated data file (DataAxiom.csv).

Determination of energetic allocation factors using a dynamic linear model

The trait FI_t was converted into net energy intake ($\mathbf{EI_t}$) by assuming a net energy density of the feed of 9.85 MJ NE/kg. The net energy available at day t ($\mathbf{NEA_t}$) was the difference between EI_t and the net energy maintenance requirements at day t ($\mathbf{MR_t}$). The value of MR_t was estimated according to Noblet et al. (2016), $MR_t = 1.05 * W_t^{0.6} * 0.74$. We represented the link between cumulative weight gain (**CW**) and cumulative NEA (**CNEA**) by a dynamic linear regression model (West and Harrison, 1997) built with the following equations:

$$CW_t = \alpha_t CNEA_{t-1} + \upsilon_{t,} \upsilon_t\ N(0, {\sigma_\upsilon}^2) \quad (1)$$

$$\alpha_t = \alpha_{t-1} + w_t w_t\ N(0, {\sigma_w}^2) \quad (2)$$

where CW_t was the time series of cumulative weight gain (kg) at day t; $CNEA_{t-1}$ was the cumulative net energy available (MJ) at day/t; α_t was a dynamic allocation factor of energy to weight gain; υ_t was a random observation error; ${\sigma_\upsilon}^2$ is the observational variance; w_t represented random and unpredictable changes in level between time $t-1$ and t; and ${\sigma_w}^2$ was the system variance. The observation EEq. (1) related CW and CNA. Eq. (2) was a system equation describing the changes in α_t (unobserved state variable) from day to day according to a stochastic process.

The model has been built using the function dlmModReg of the package dlm (Petris et al., 2009) of the software R (https://www.r-project.org/). The parameters ${\sigma_\upsilon}^2$ and ${\sigma_w}^2$ were estimated by maximum likelihood with the function dlmMLE. The values of α_t were calculated independently for each animal with a Kalman smoother algorithm (function dlmSmooth). The R script (DLM_script.R) contains the workflow to do the estimation of α_t across time for a given animal. The identification of the individual (ID), from 1 to 100, to estimate must be specified at the beginning of the script. The various estimated variables are exported in the Result.csv file: ID, t, W_t, FI_t, EI_t, MR_t, NEA_t, $CNEA_t$, CW_t, α_t. The value of α_t at t = 1 is not estimable because the consumption at $t-1$ is unknown.

The average results for the whole dataset are presented in Table 1. The minimum feed intake value equal to zero was measured on animals #6 and #7, from fattening group 202,025 and pen number 13, without any intake during day 2. This was due to a mechanical problem of the AFS. Figs. 1 and 2 show the example

Table 1
Descriptive statistics (Mean, Minimum, Maximum and SD: standard deviation) of the variables recorded or estimated on fattening pigs.

Variable	Mean	Minimum	Maximum	SD
Weight (W – kg)	70.1	23.8	133.0	22.0
Feed Intake/day (FI – kg)	2.23	0	5.02	0.64
Energy Intake/day (EI – MJ)	21.99	0	49.47	6.29
Energy maintenance requirements/day (MR – MJ)	9.83	5.20	14.61	1.90
Net Energy Available/day (NEA – MJ)	12.16	−11.88	36.15	5.09
Cumulated Net Energy Available (CNEA – MJ) over testing period	389.78	652.79	1 257.89	137.42
Allocation factor/day (α – kg/MJ)	0.099	0.061	0.225	0.019

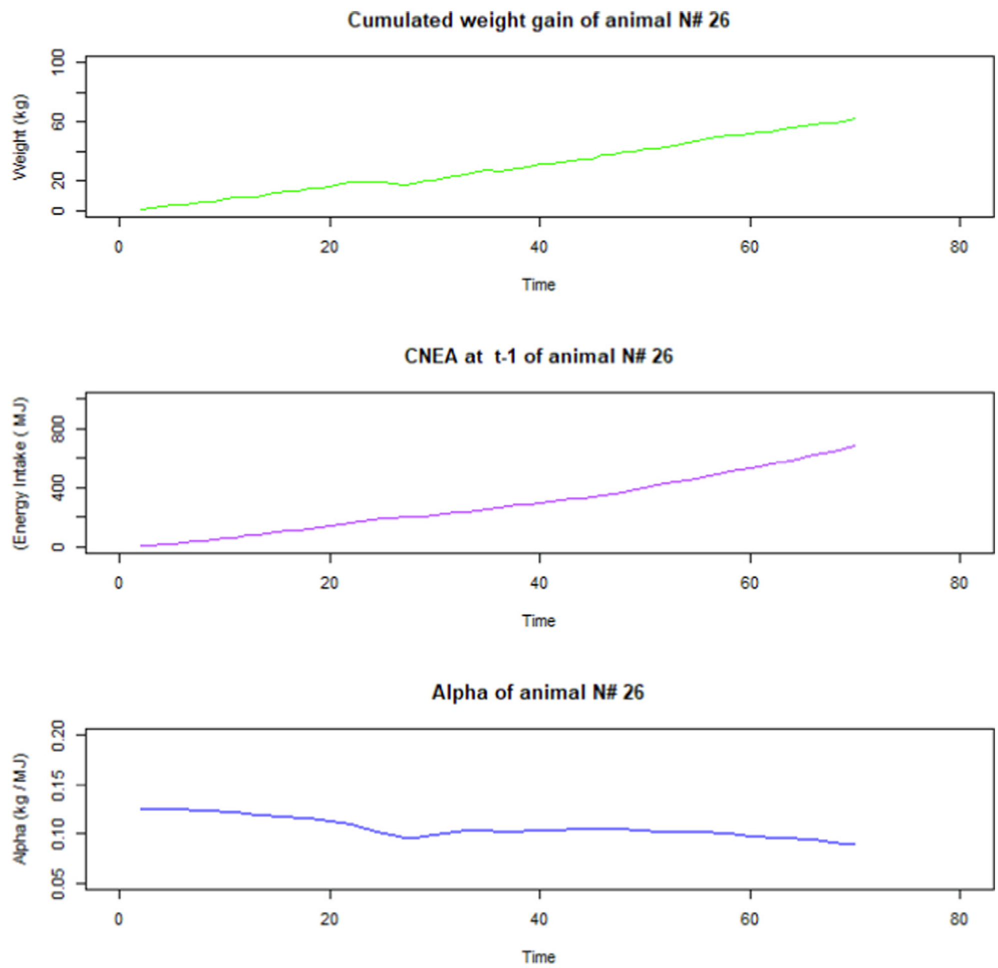

Fig. 1. Dynamics of cumulative weight gain (CW_t), of cumulative net energy available ($CNEA_{t-1}$) and of allocation factors (α_t) estimated dynamic linear model over the testing period for fattening pig #26.

of the dynamics of CW_t, $CNEA_t$ and of α_t estimates for animals #26 and #90, respectively.

Ethics approval

The data were obtained from pre-existing databases provided by AXIOM. Animals were raised under commercial conditions and were cared for according to EU-Council directive 2008/120/EC of 18 December 2008 laying down minimum standards for the protection of pigs (https://data.europa.eu/eli/dir/2008/120/oj).

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Author contributions

KK and CC managed data collection on farm, equipment follow-up and developed the database to store and share the data. GL and KK developed the data pretreatment process. GL, LFG and RMT implemented and tested the dynamic linear model applied to the concept of allocation. GL, RMT and LFG drafted the paper. All authors read and approved the final manuscript.

Declaration of interest

GL, LFG, CC and KK are employed by the company AXIOM. There is no conflict of interest to be declared.

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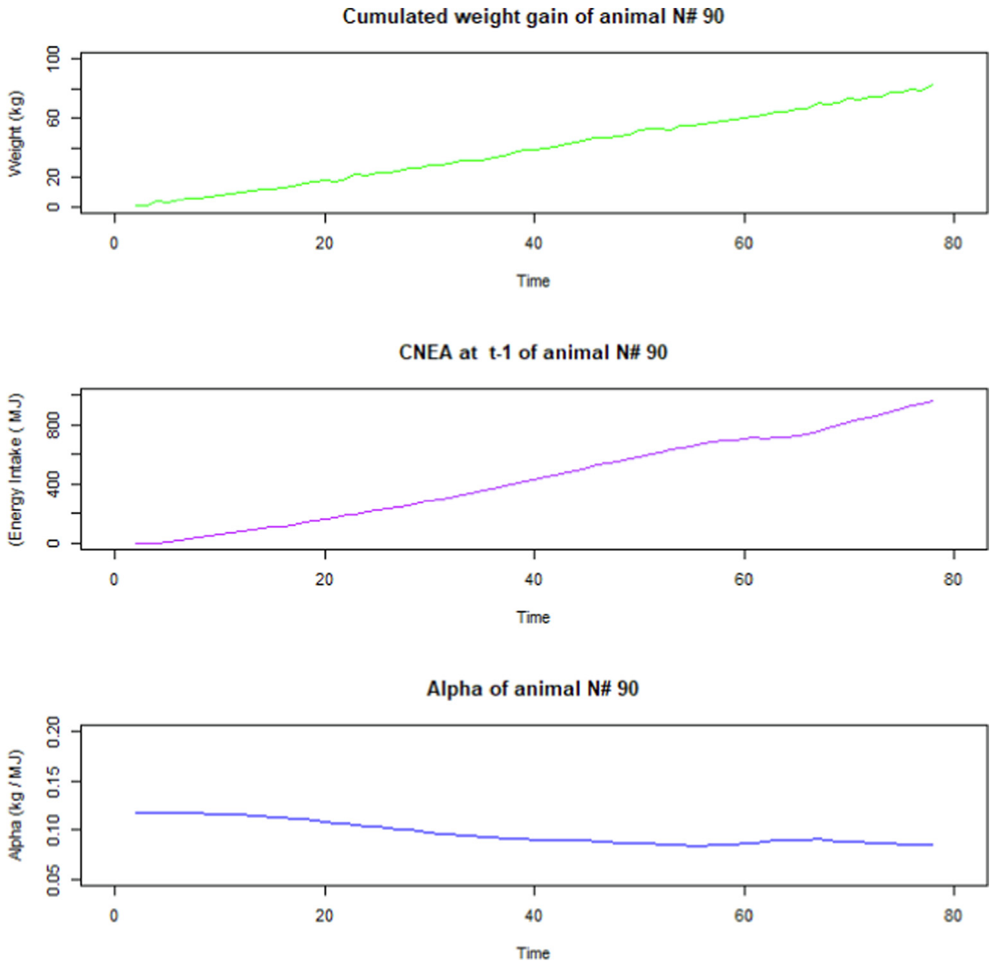

Fig. 2. Dynamics of cumulative weight gain (CW_t), of cumulative net energy available ($CNEA_{t-1}$) and of allocation factors (α_t) estimated dynamic linear model over the testing period for fattening pig #90.

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