Session 48: Sheep and goats Free communications

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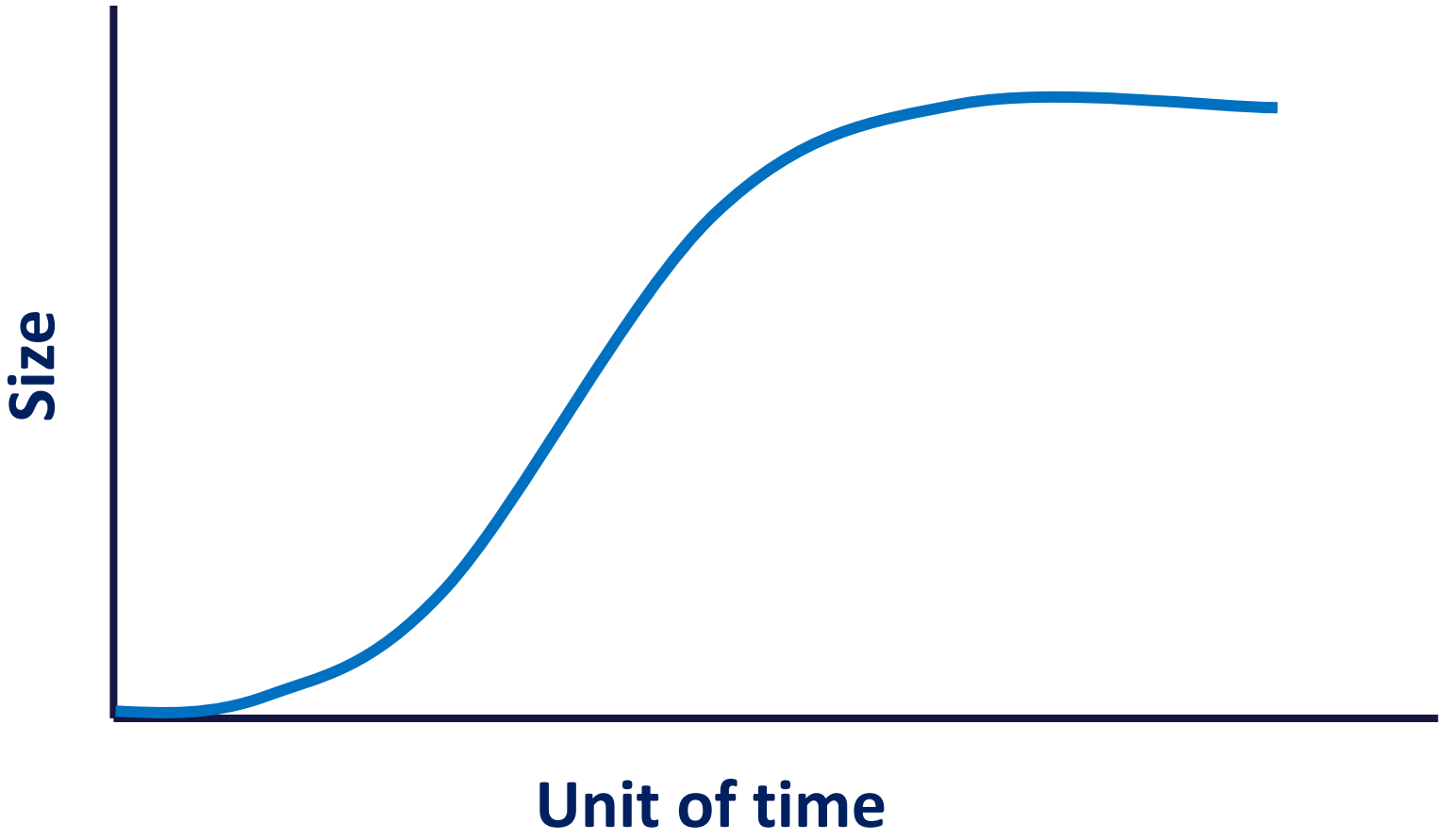
Plan

Ash and protein deposition patterns in the body of Saanen goats

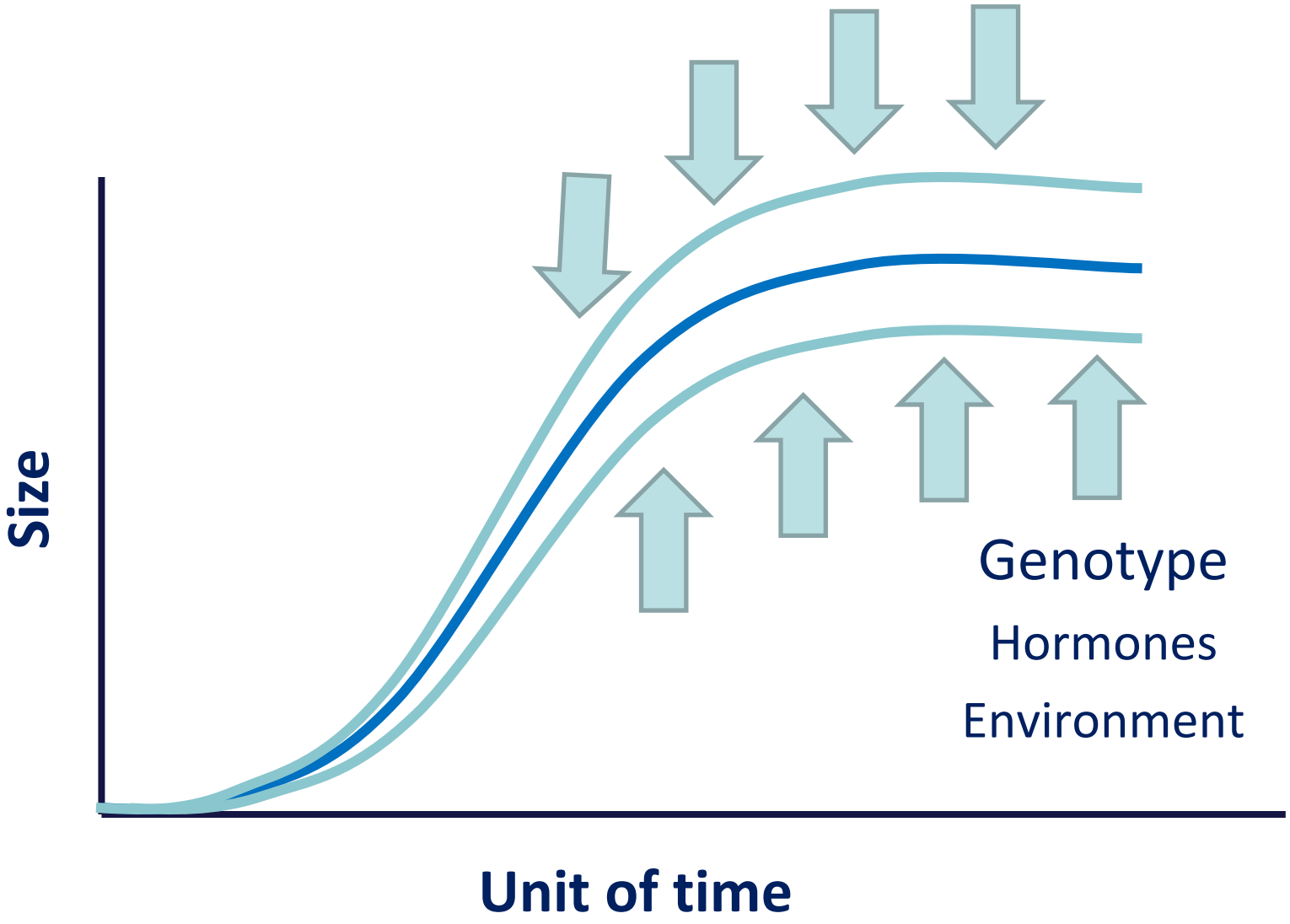
Mature size of Saanen goats

Ash and protein deposition patterns in the body of Saanen goats

Background

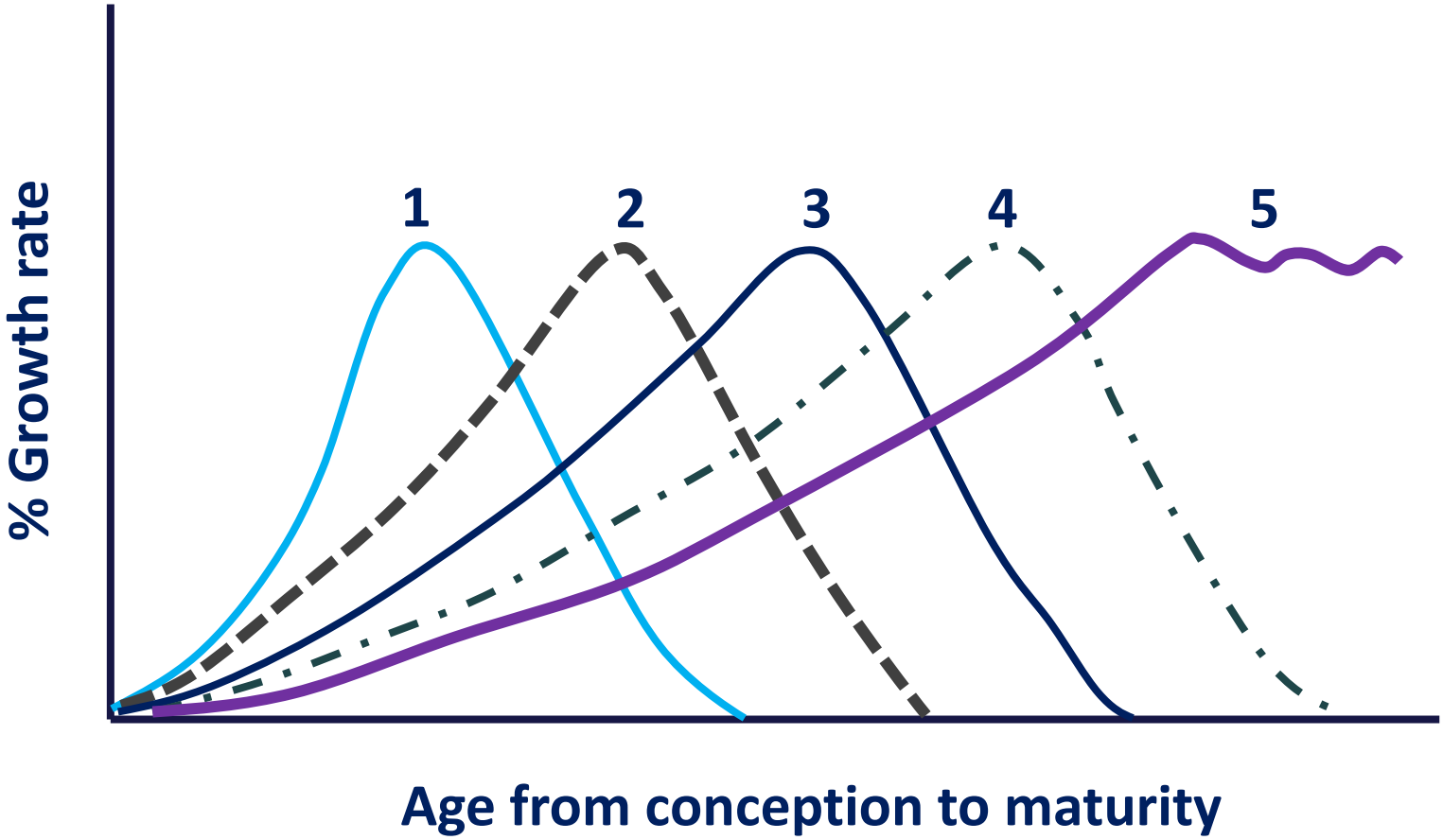


Conceptual model of animal growth.



Conceptual model of animal growth.

Background

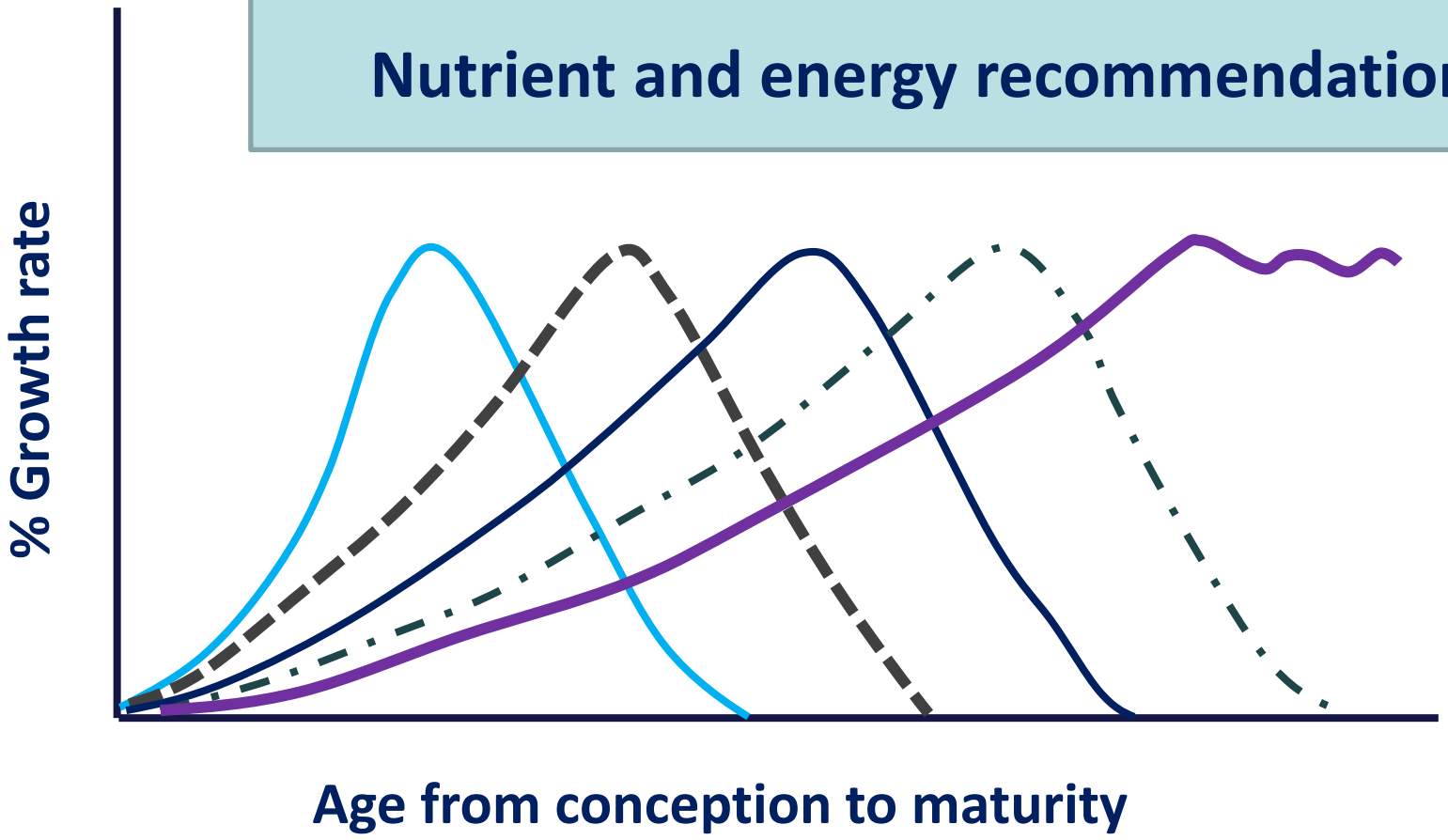


Waves of growth: 1 – nervous tissue; 2 – bone; 3 – muscle; 4 – fat; 5 – daily feed intake (Lawrence and Fowler, 2002)

Background

Intake and performance (ADG) prediction

Nutrient and energy recommendation



Objective

Meta-analysis → to fit a **growth curve** that describes the increase of **protein** and **ash** contents in empty body mass (**EBM**).

Database (5 studies)

Individual records: 76 female Saanen goats

Diet: dehydrated corn plant or Tifton hay, ground corn, soybean meal, soybean oil, limestone, mineral supplement and ammonium chloride

16.6 ± 1.9% of CP and 4,172.5 ± 278 kcal/kg of GE (DM basis).

Statistical analysis

Selection of candidate equations

Preliminary graphical examination

Brody, Gompertz, Logistics, Von Bertalanffy and Richards

Fitted using a **nonlinear mixed model** methodology (SAS macro %NLINMIX; SAS Inst. Inc., Cary, NC; v. 9.4).

Between-study variability

u_1, u_2 and **u_3** to the β_0, β_1 and β_2 parameters.

Results and discussion

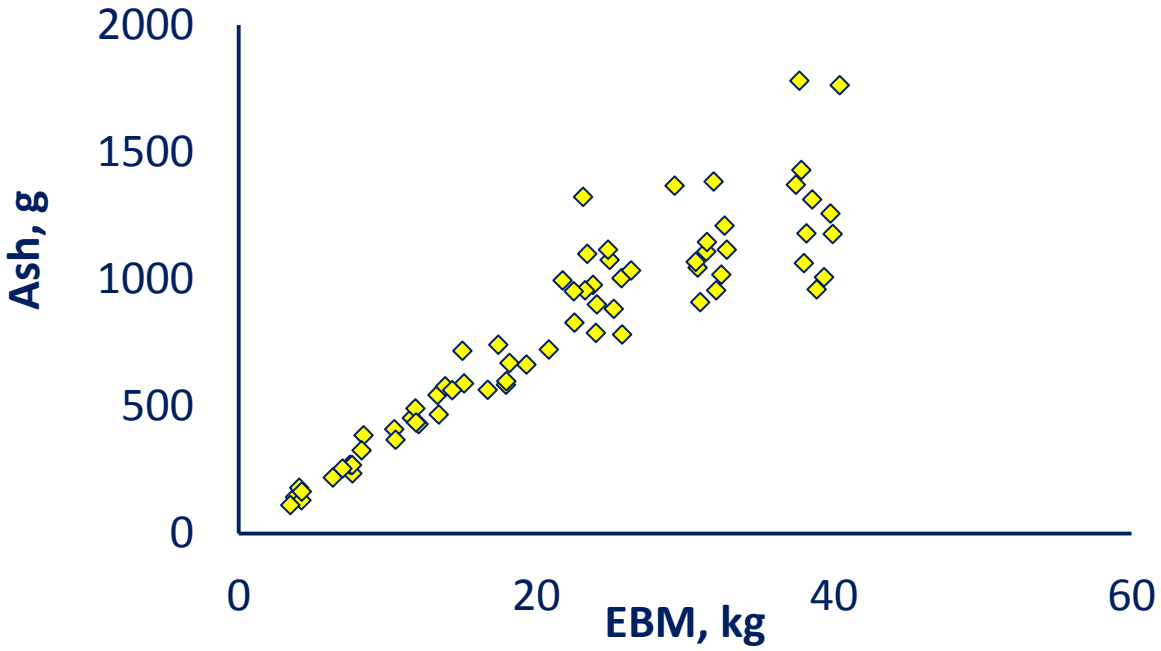
Gompertz growth function

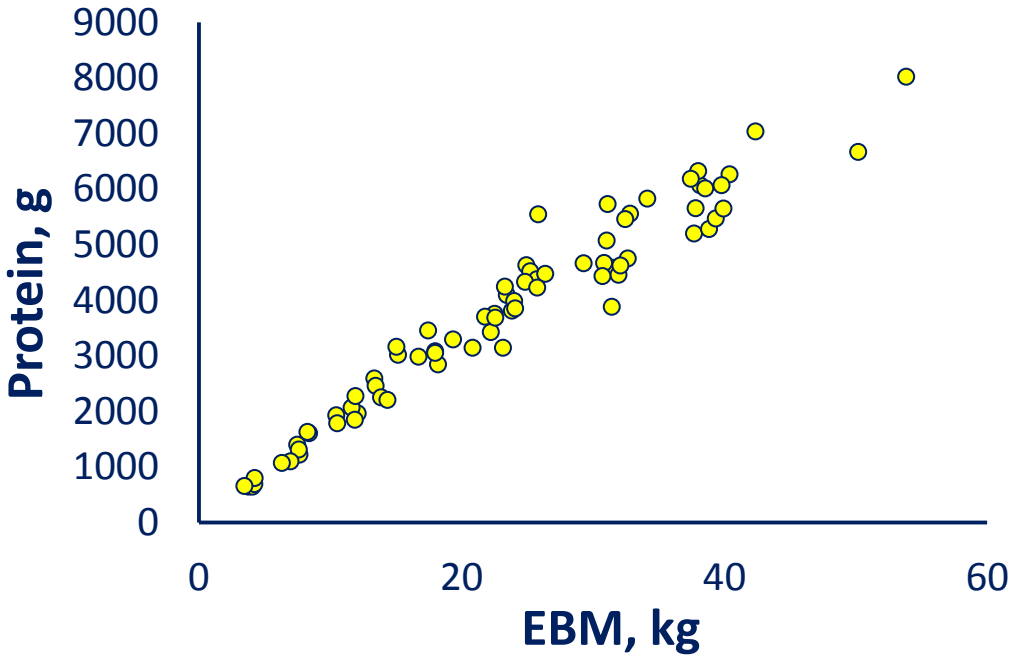
$$CP \text{ or } Ash = (\beta_0 + \mathbf{u_1}) \times \exp^{(\beta 1 + \mathbf{u2}) \times (1-\exp-(\beta 3 + \mathbf{u3}) \times EBM)} + e$$

Descriptive statistics of the database

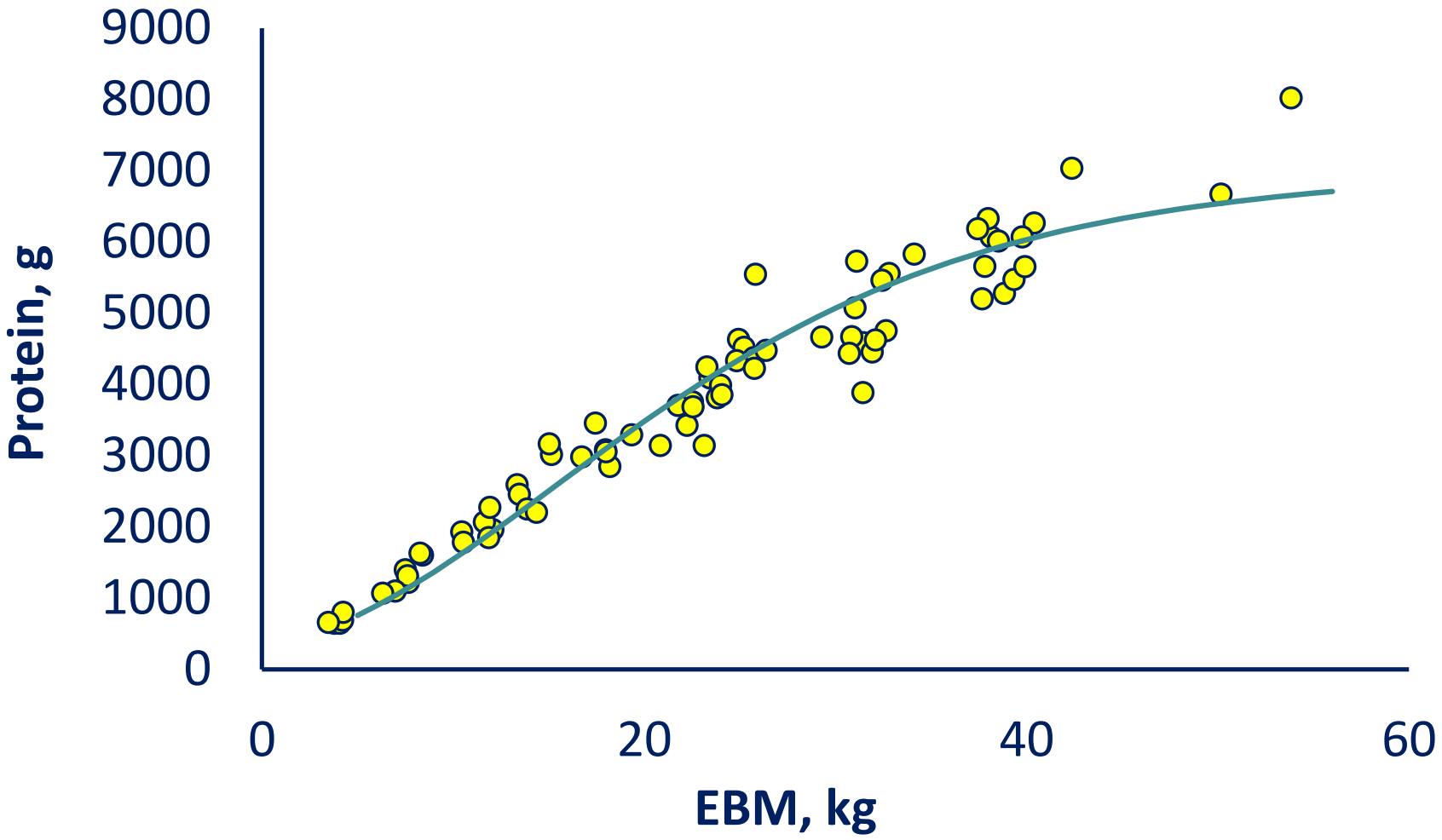
Variable	n	Mean	SD	Min.	Max.
Age, d	76	227.0	126.5	18.0	585.0
DMI, g/d	76	743.6	333.5	270.5	1528.2
BM, kg	76	25.7	11.9	4.6	59.4
EBM, kg	76	22.1	11.1	3.5	53.3
Ash, g	76	850.2	461.6	111.7	2356.5
Protein, g	76	3480.9	2014.8	689.9	8638.5

BM = body mass; DMI = dry matter intake; EBM = empty body mass;
SD = standard deviation, Min. = minimum; Max. = maximum.


2000
1500
1000
500
0
Ash, g
0
20
40
60
EBM, kg

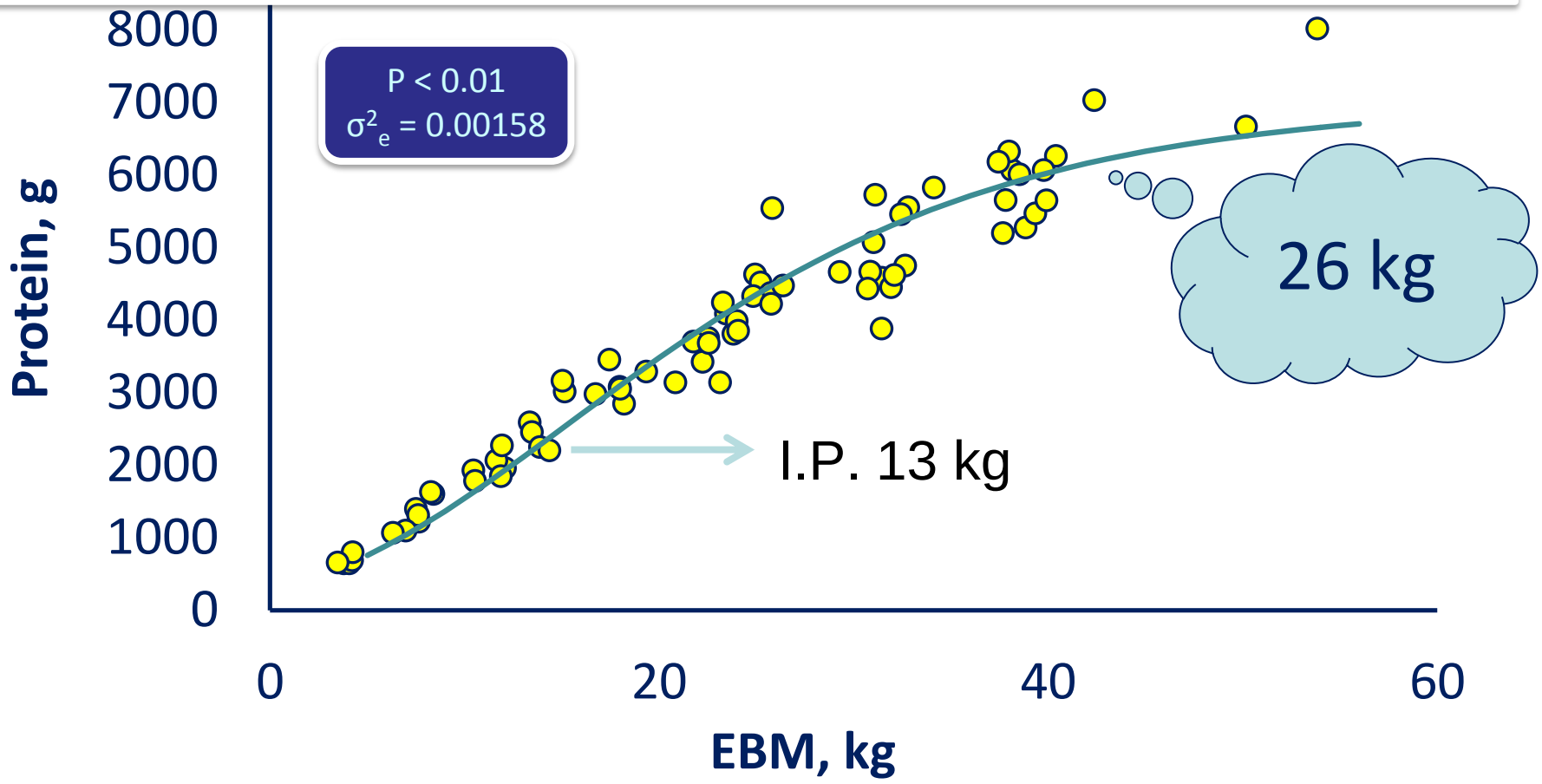

9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Protein, g
0
20
40
60
EBM, kg

Results and discussion

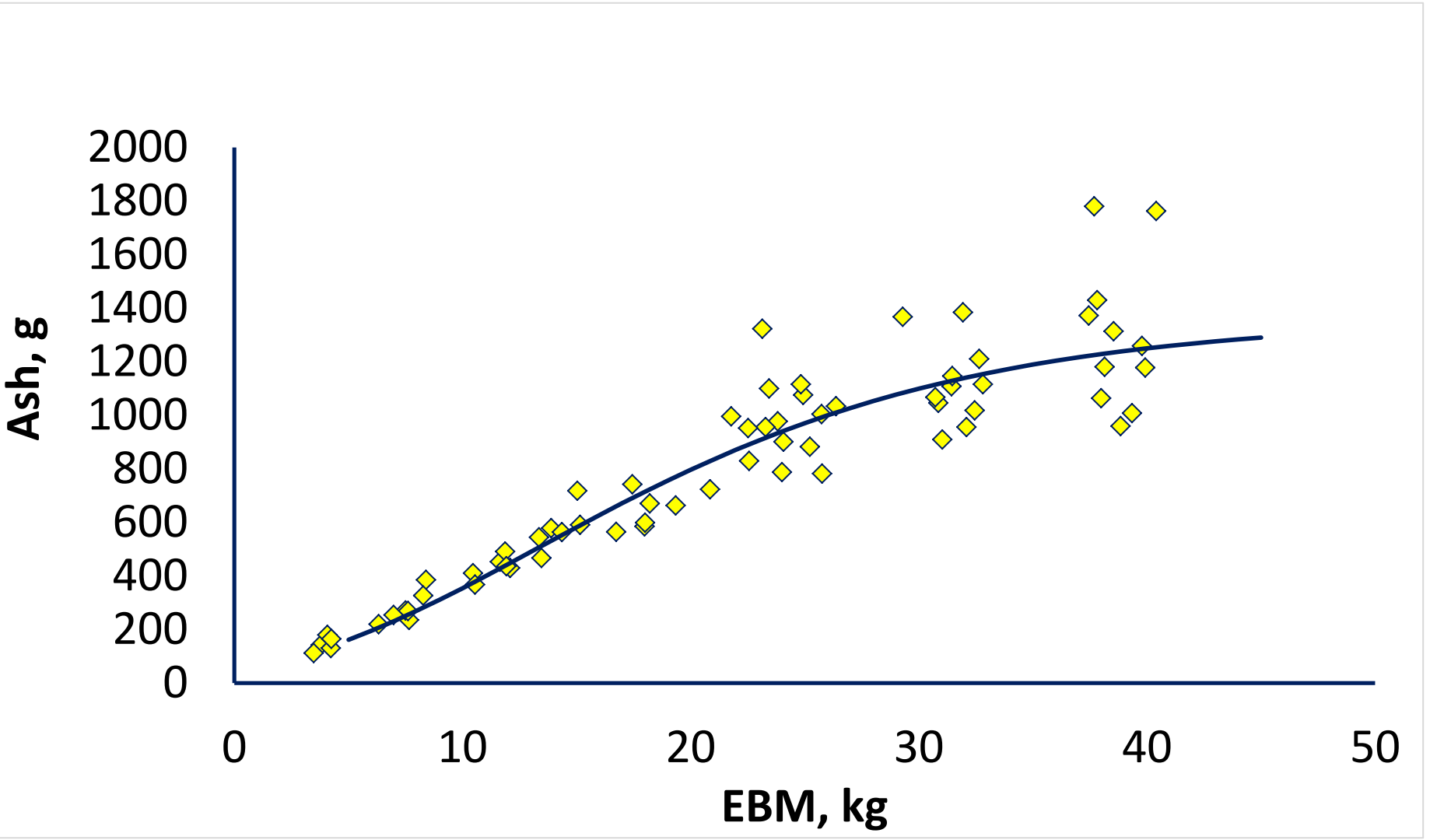


Results and discussion

$$\textit{Protein, g} = 300.1 \pm 24.5 \times \exp^{3.15 \pm 0.0801 \times (1-\exp -0.0772 \pm 0.00480 \times \textit{EBM}, \text{ kg})}$$

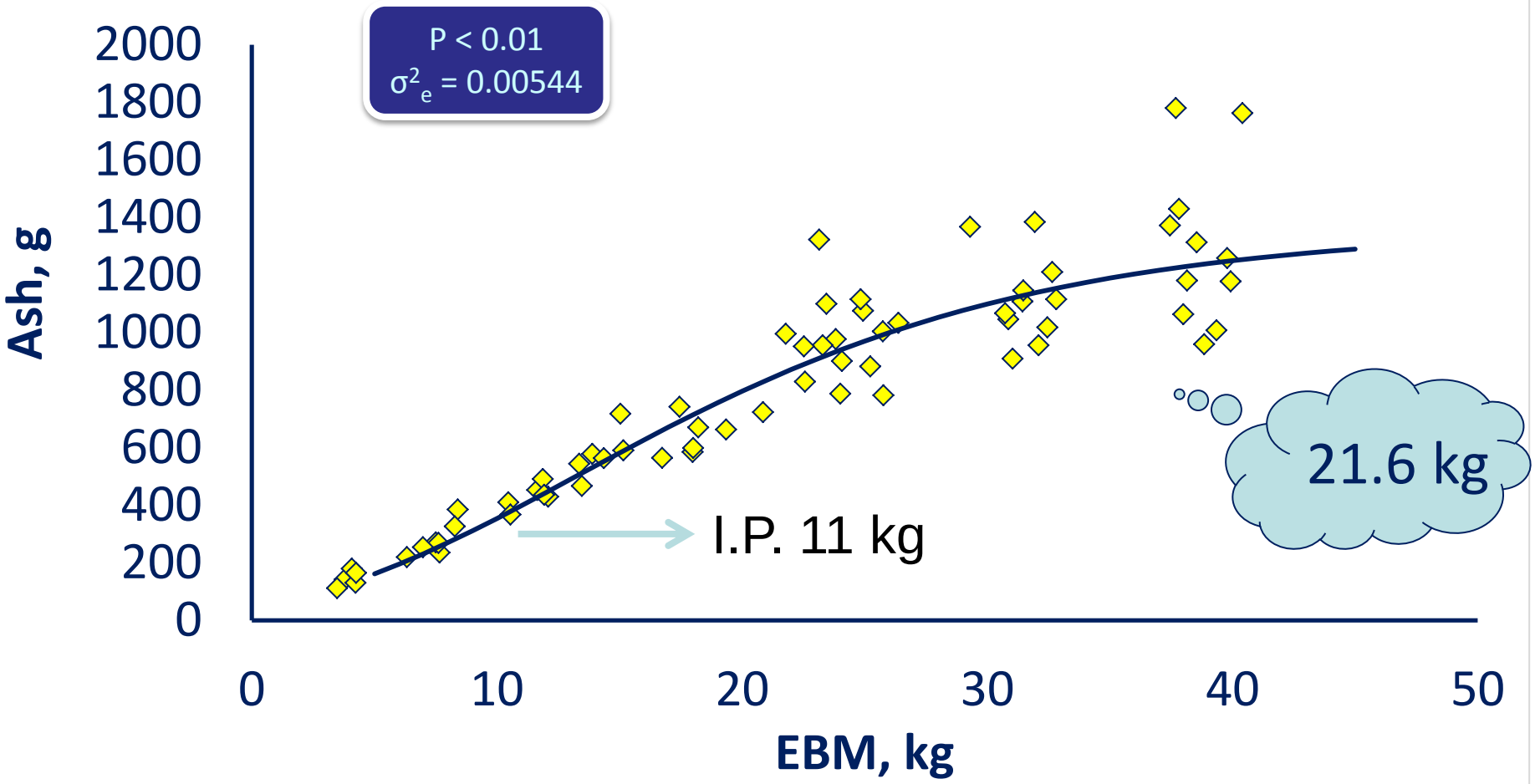


Results and discussion



Results and discussion

$$Ash,\ g = 53.7 \pm 7.10 \times \exp^{3.232 \pm 0.119 \times (1 - \exp -0.0922 \pm 0.00793 \times EBM,\ kg)}$$



Conclusion

- ✓ Model protein and ash deposition pattern

Equations

Mature size of Saanen goats

Background

MATURITY

Mature weight
Standard reference weight
Mature size

INRA, (1989); CSIRO, 2007; NRC, 2000, 2007

Intake, nutritional requirements

Background

MATURITY ????

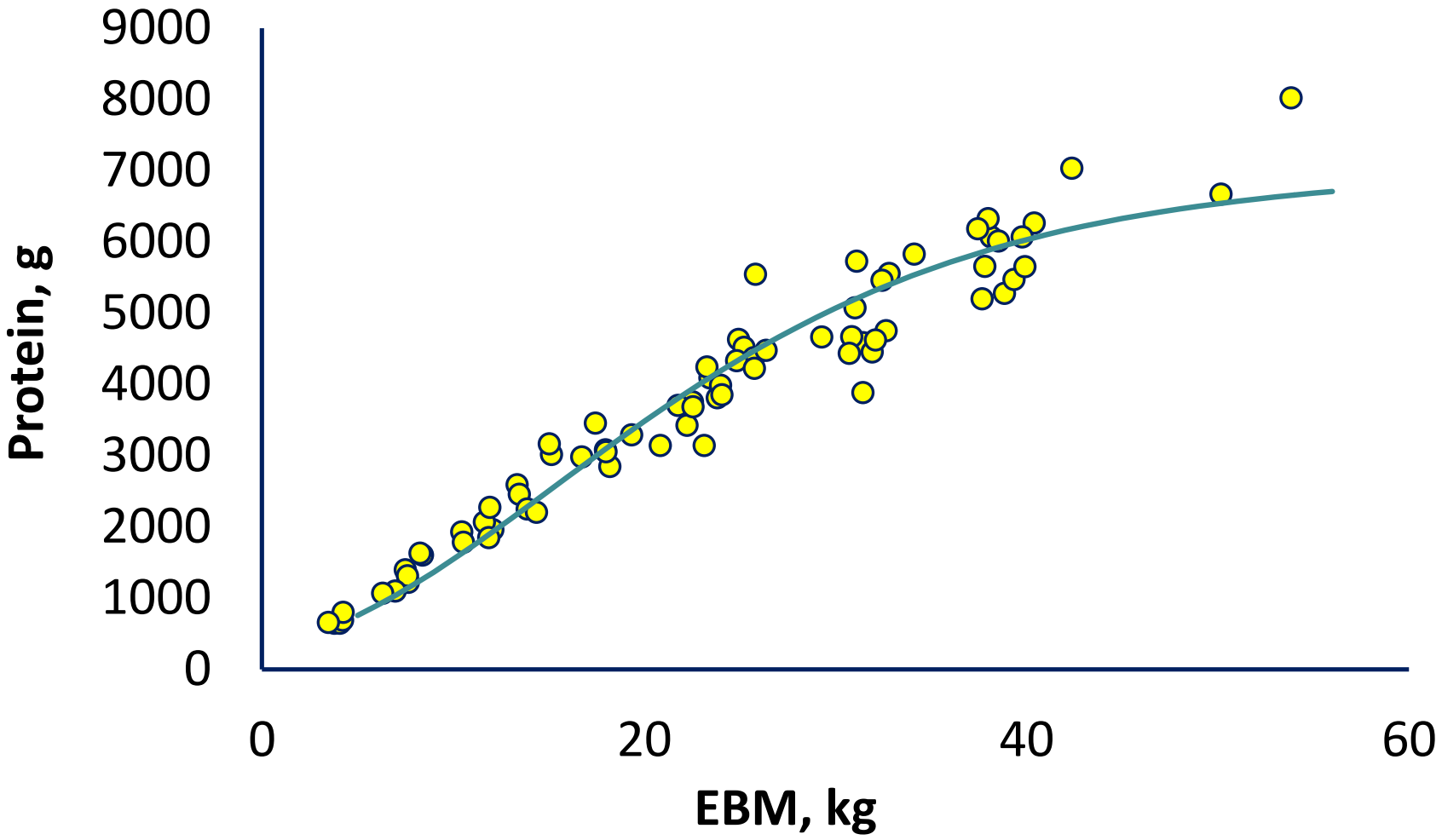
Background

Moulton (1923) – proposed the concept of **chemical maturity** (when the total protein, water, and mineral contents in the fat-free basis reach a plateau).

Background

The NRC (2000) - supported that the chemical maturity may be achieved through the **stabilization of protein accretion** in the empty body.

Stabilization of protein accretion?



Background

CSIRO (2007) - considered the achievement of **skeletal development** of a medium BCS animal to define the "standard reference weight", known as mature weight.

Background

Trenkle and Marple (1983), and Tedeschi et al. (2002) - assumed that an animal would reach maturity when the **ether extract** content of the empty body was around 22%.

Scenario

Lack of definition of appropriate estimators (i.e., protein, ash, water, or fat) of mature weight.

Objective

Meta-analysis → to provide approaches to estimate maturity of female Saanen goats **(body composition)**

Database (5 studies)

Individual records: 76 female Saanen goats

Diet: dehydrated corn plant or Tifton hay, ground corn, soybean meal, soybean oil, limestone, mineral supplement and ammonium chloride

16.6 ± 1.9% of CP and 4,172.5 ± 278 kcal/kg of GE (DM basis).

Statistical analysis

Selection of candidate equations

Preliminary graphical examination

Logistic function: $Y = \beta_0 \times \exp^{(-\beta 1 \times EBM)+\beta 2}$

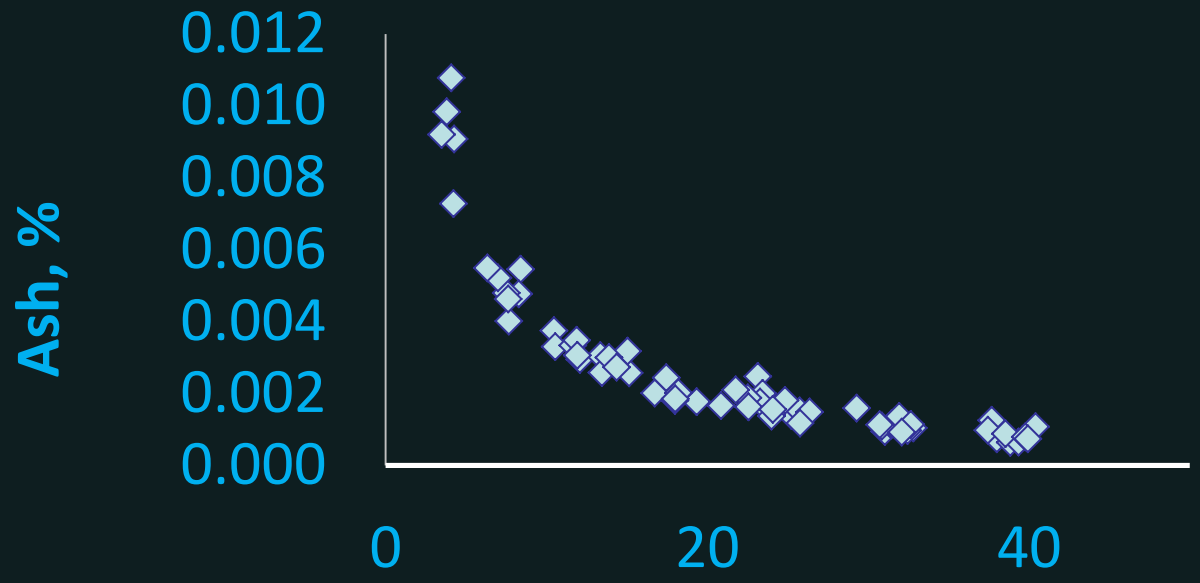
Where β_2 is the asymptotic of ash or protein:fat ratio

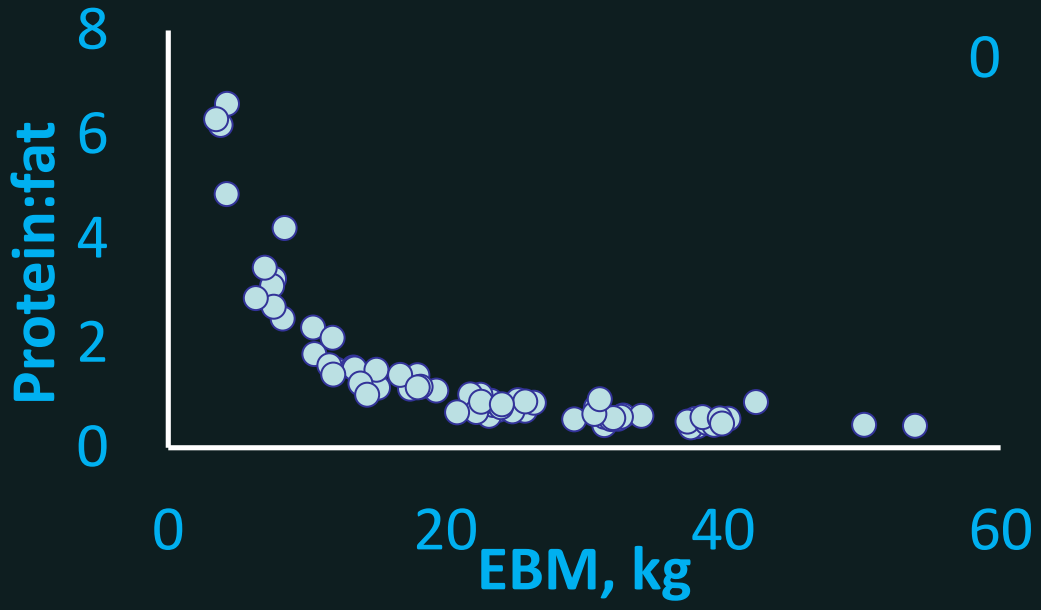
Fitted using a **nonlinear mixed model** methodology (SAS macro %NLINMIX; SAS Inst. Inc., Cary, NC; v. 9.4).

Between-study variability

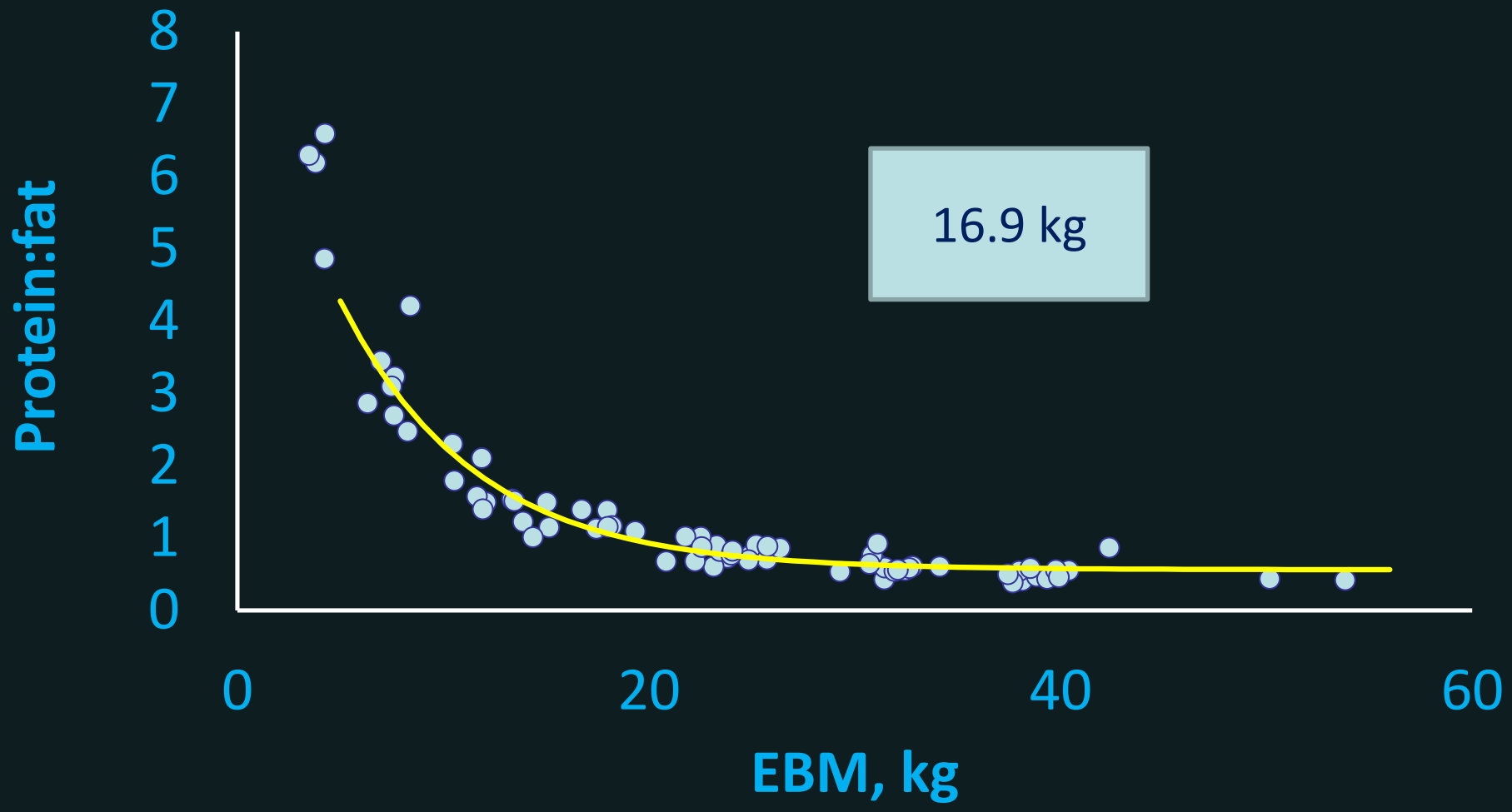
$\mathbf{u_1}$, $\mathbf{u_2}$ and $\mathbf{u_3}$ to the β_0, β_1 and β_2 parameters.

Results and discussion

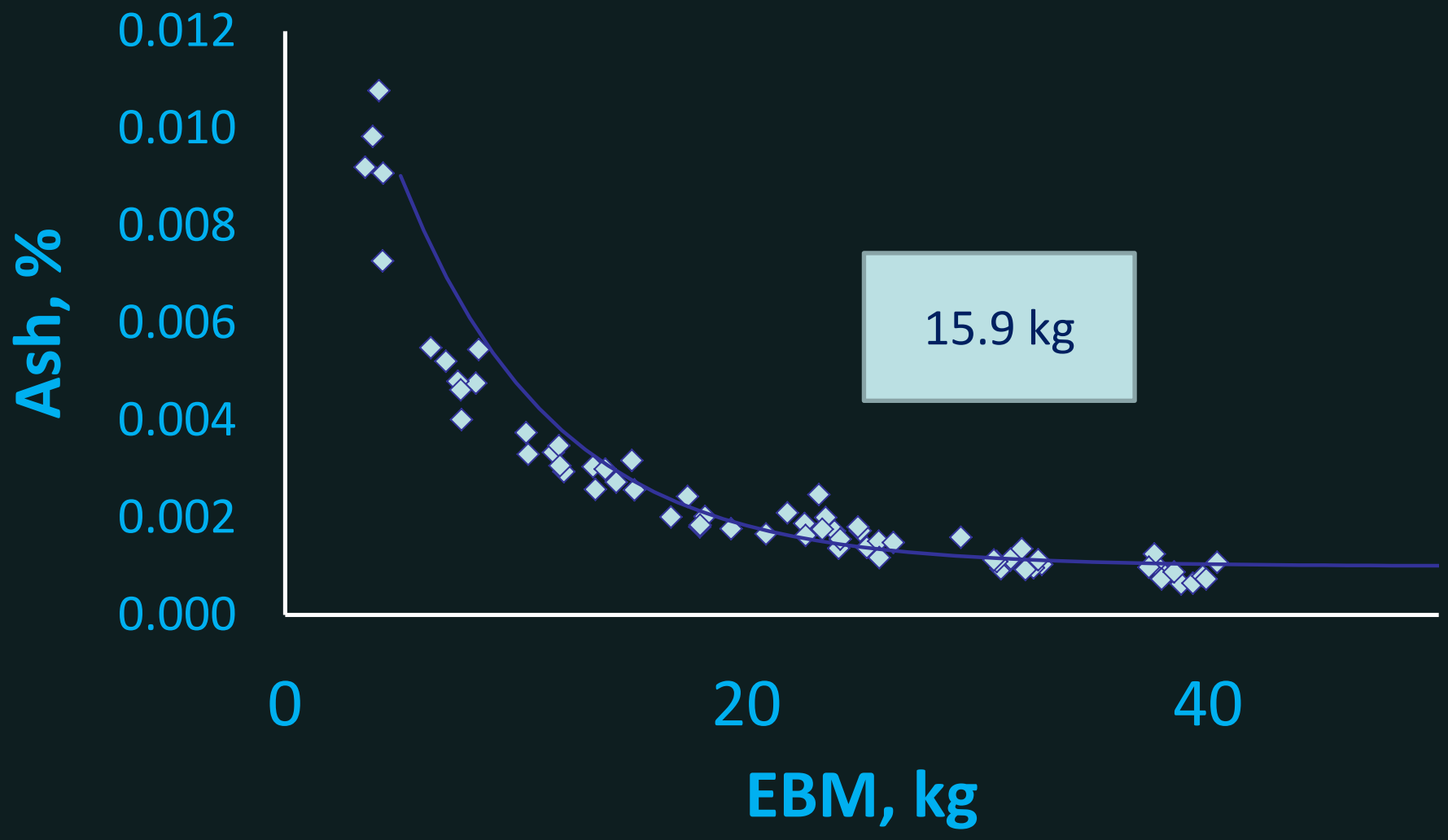




Results and discussion



Results and discussion



A bit more...

$$y = \beta_0 \times (1 + exp^{(\beta_1 \times EBM)}) + e$$

Where *y* is empty body **protein** percentage in the water-free EBM; β_0 and β_1 are the parameter estimates and *e* is the residual.

A bit more...

$$\text{EBP, \%} = 36.7 \pm 2.51 \times \left(1 + exp^{\left(-0.0747 \pm 0.023 \times EBM\right)}\right)$$

Plateau – 27 kg EBM = 22.8 % of EBF

Trenkle and Marple (1983), and Tedeschi et al. (2002)

Final remarks

The identification of **mature size** is an important step to adequately formulate diets.

Standardize the method of estimation.

Effect of breed, sex and nutrition...

Acknowledgments

Thank you.

Co-workers

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