

monoguthealth

Optimal gut function in monogastric livestock

Intrauterine growth restriction, defined by a high brain-to-liver weight ratio, affects fecal microbiota composition and, to a lesser extent, plasma metabolomics in pigs.

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Introduction

The **economy** of pig production relies on the **reproductive performance** of the sows



...and the number of piglets exposed to **intrauterine growth restriction (IUGR)**



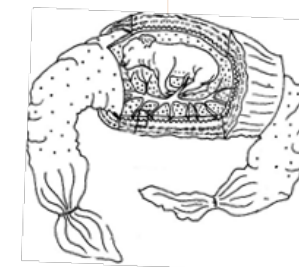
Insufficient space within the uterus is the main cause of IUGR



Genetic selection increased the **number of piglets born per litter**

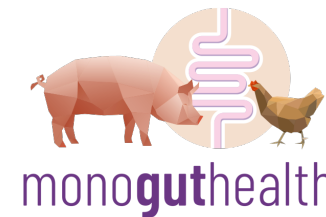


IUGR is defined as the **failure** of the foetus to reach its **genetically expected growth**



Uterine **overcrowding** is associated with decreased uterine blood flow per foetus

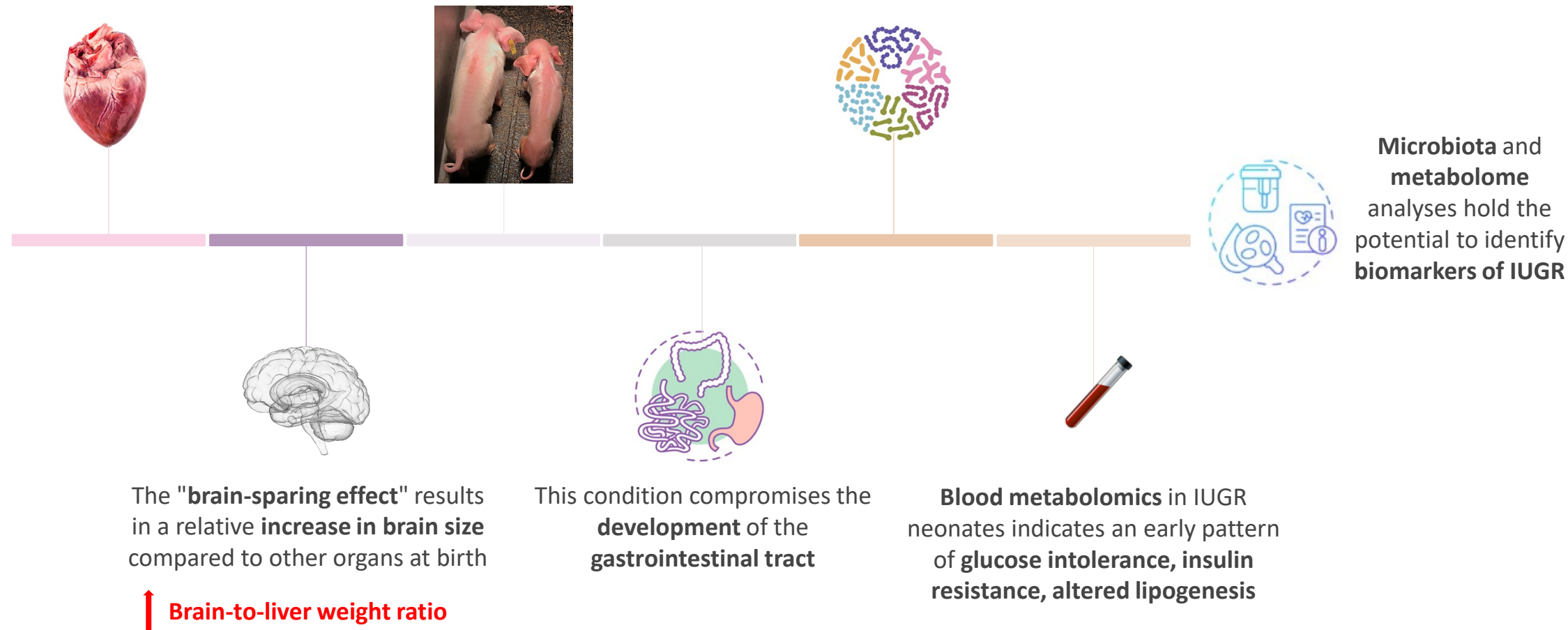
Introduction



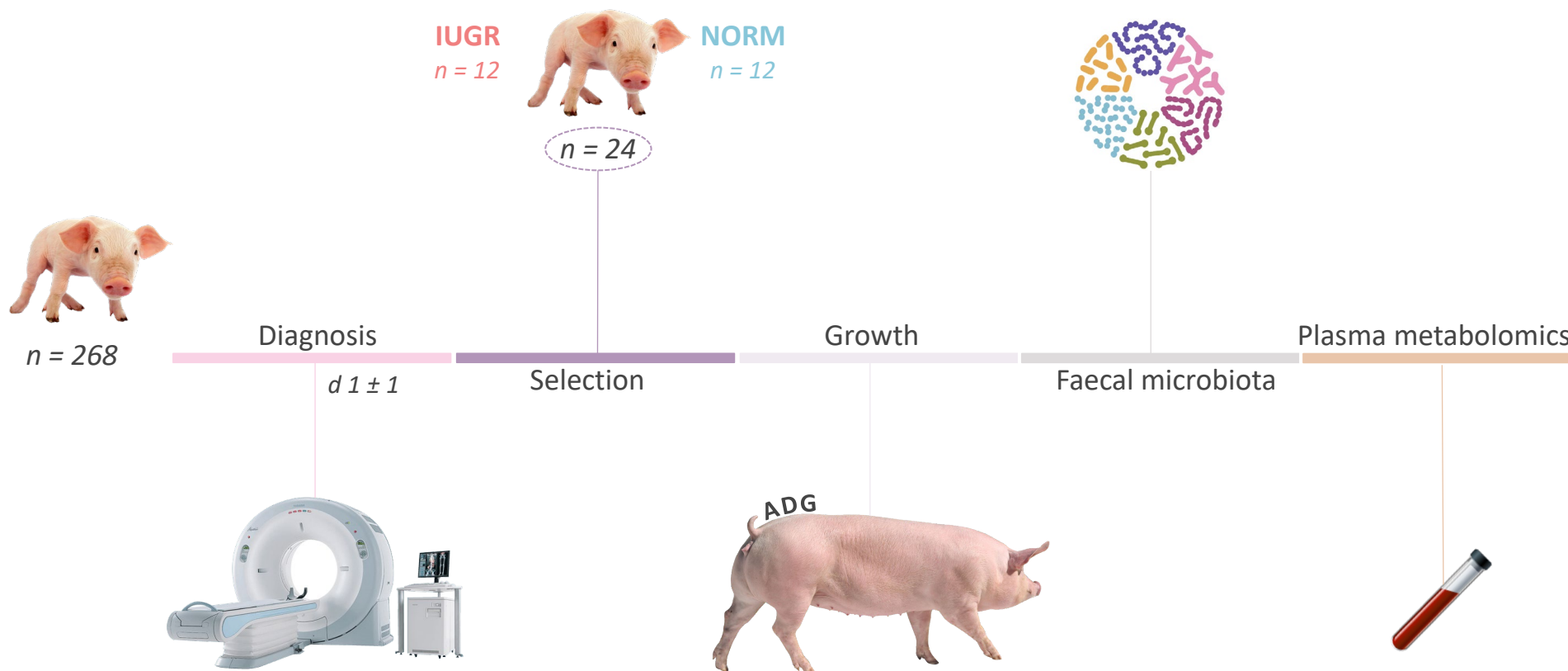
The supply of oxygen and nutrients to the **brain** is **prioritized**

IUGR pigs show higher **morbidity** and **mortality** rates, **stunted growth**, and **reduced feed efficiency**

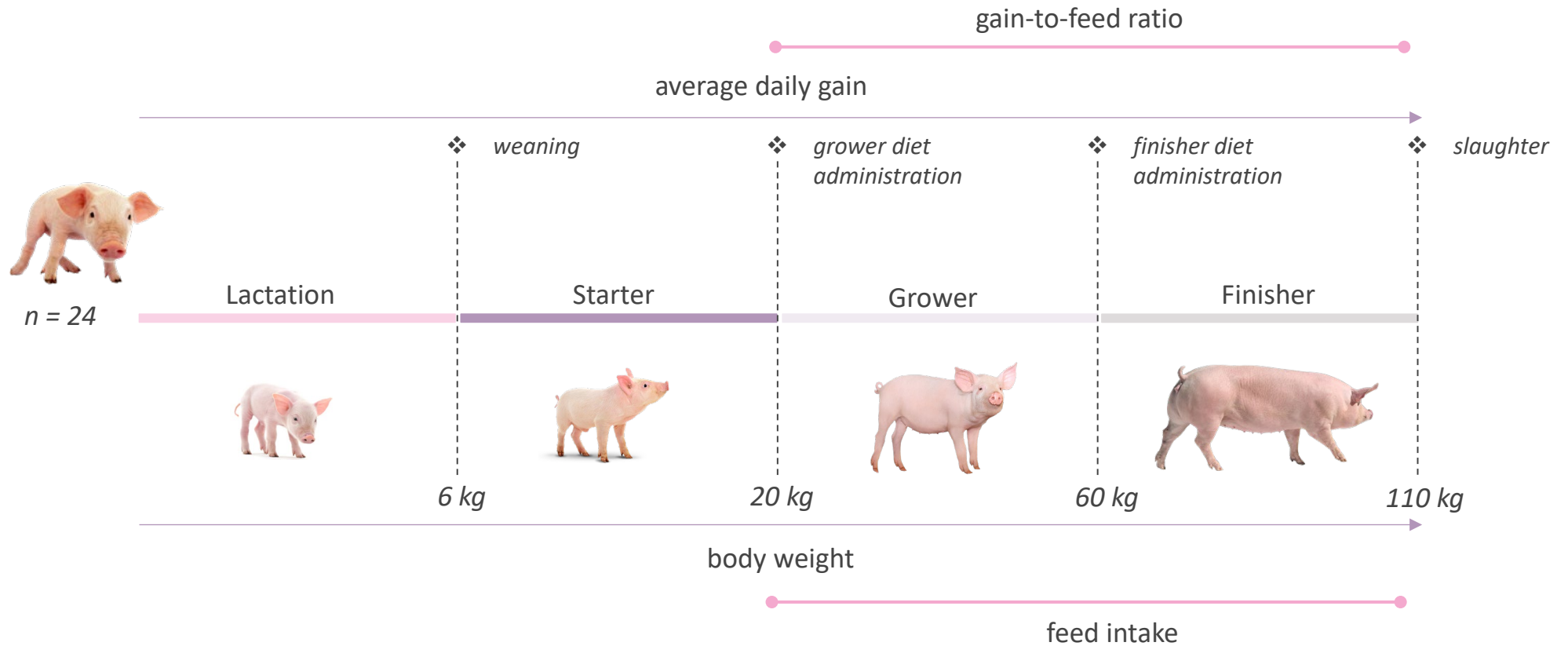
An adverse uterine environment alters the **microbial colonization** of the gastrointestinal tract



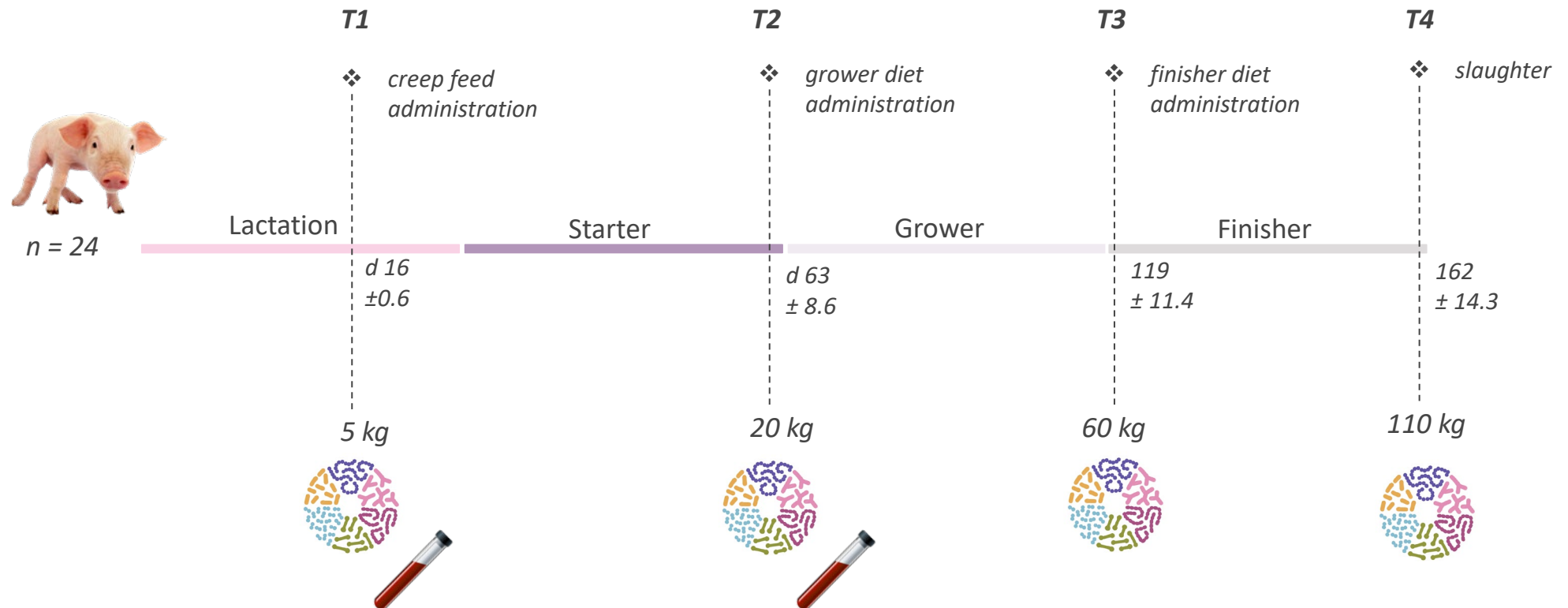
Materials and methods



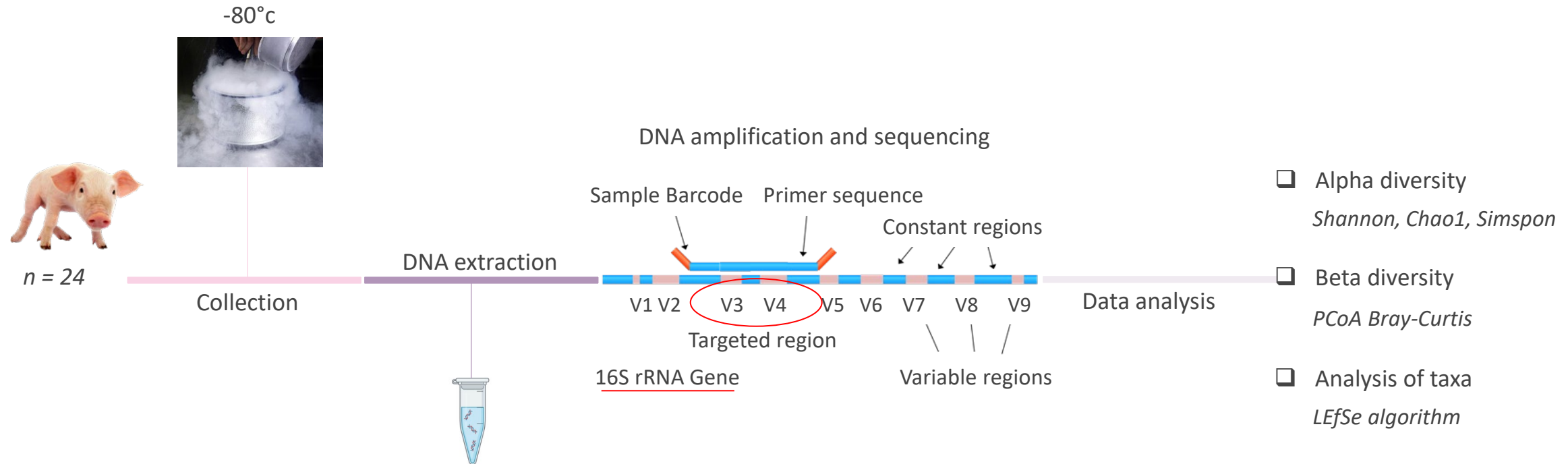
Materials and methods – growth



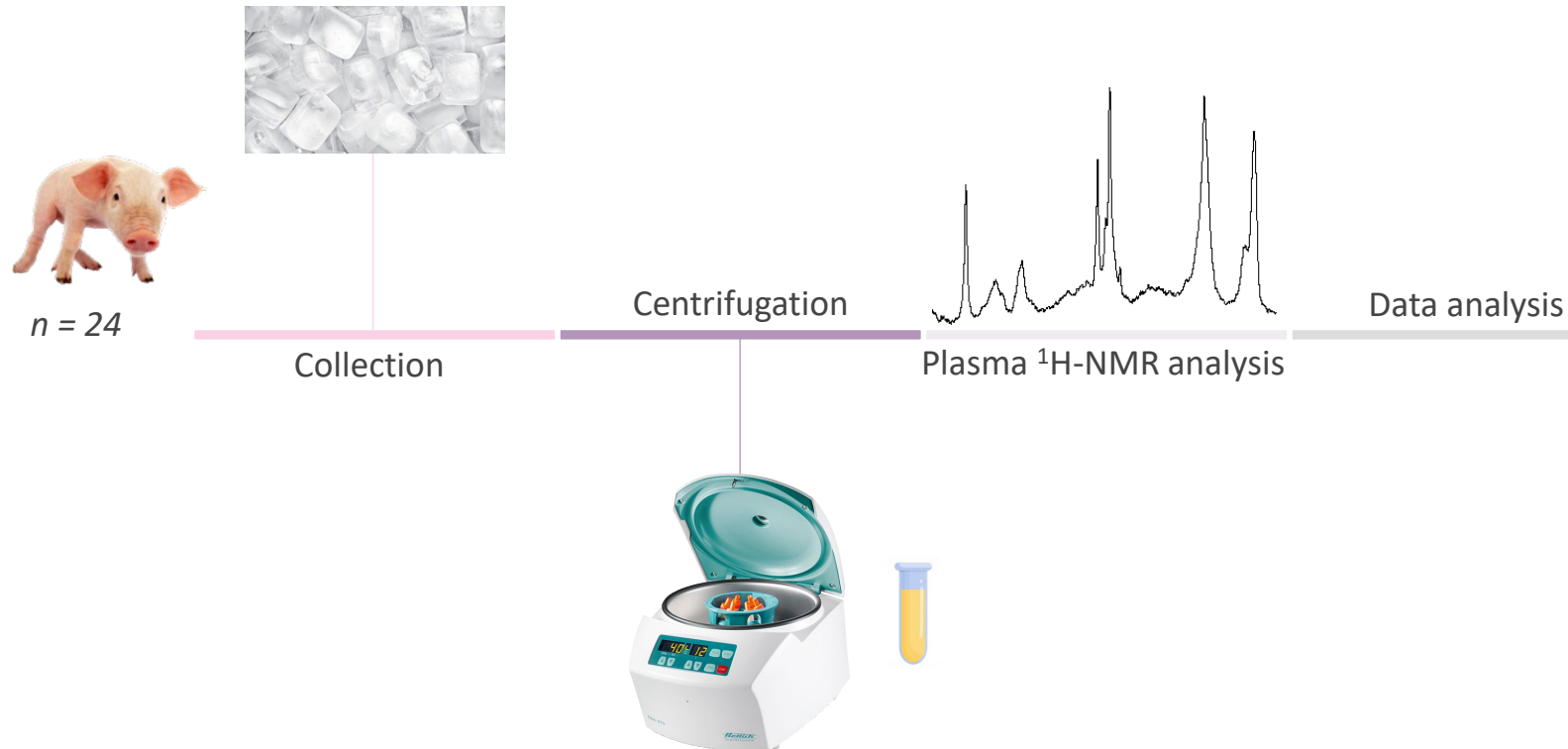
Materials and methods – faeces and blood sampling



Materials and methods – faecal microbiota analysis

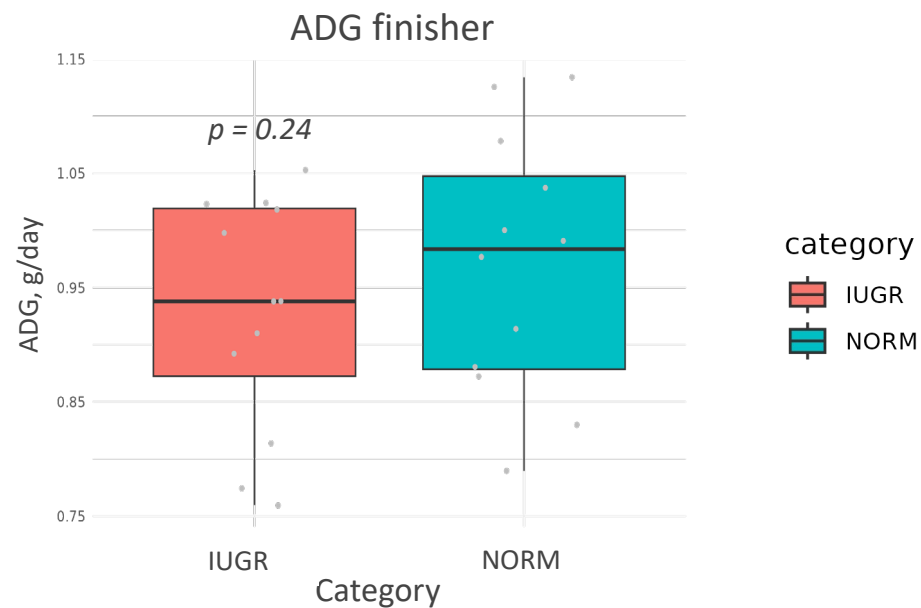
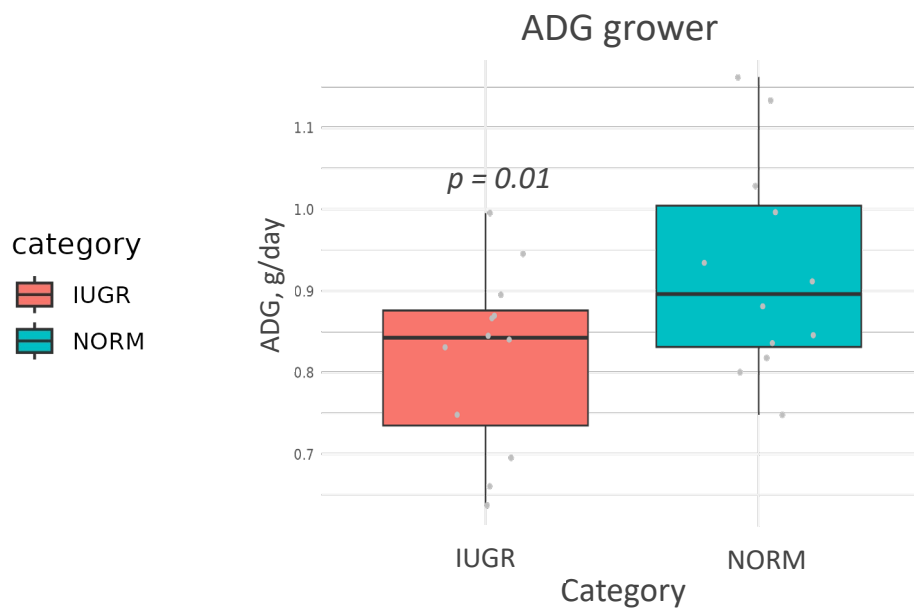
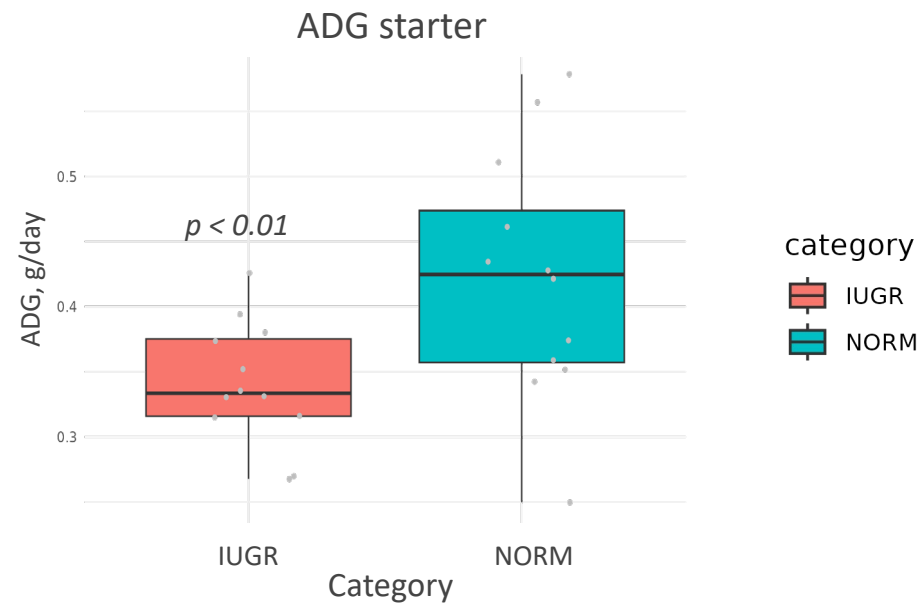
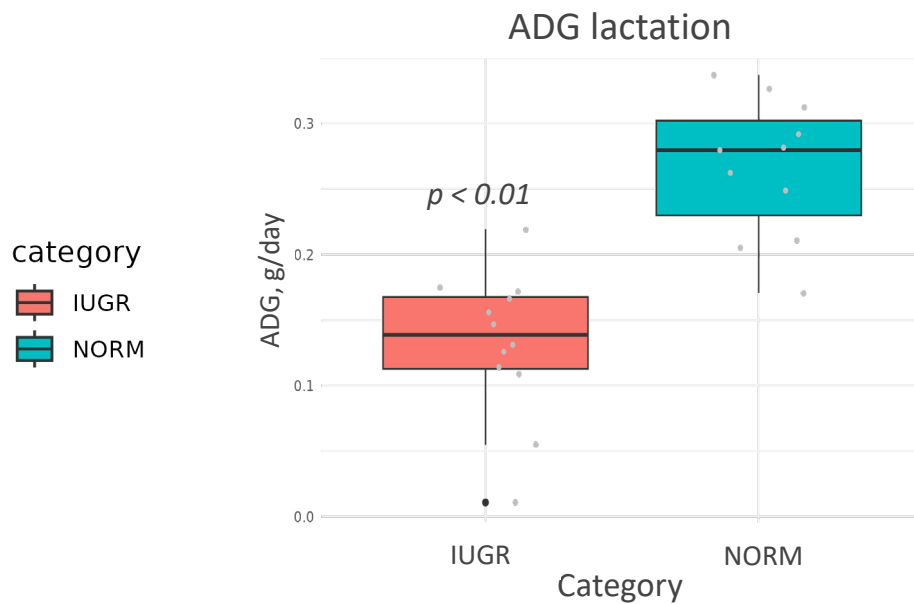


Materials and methods – plasma metabolome analysis

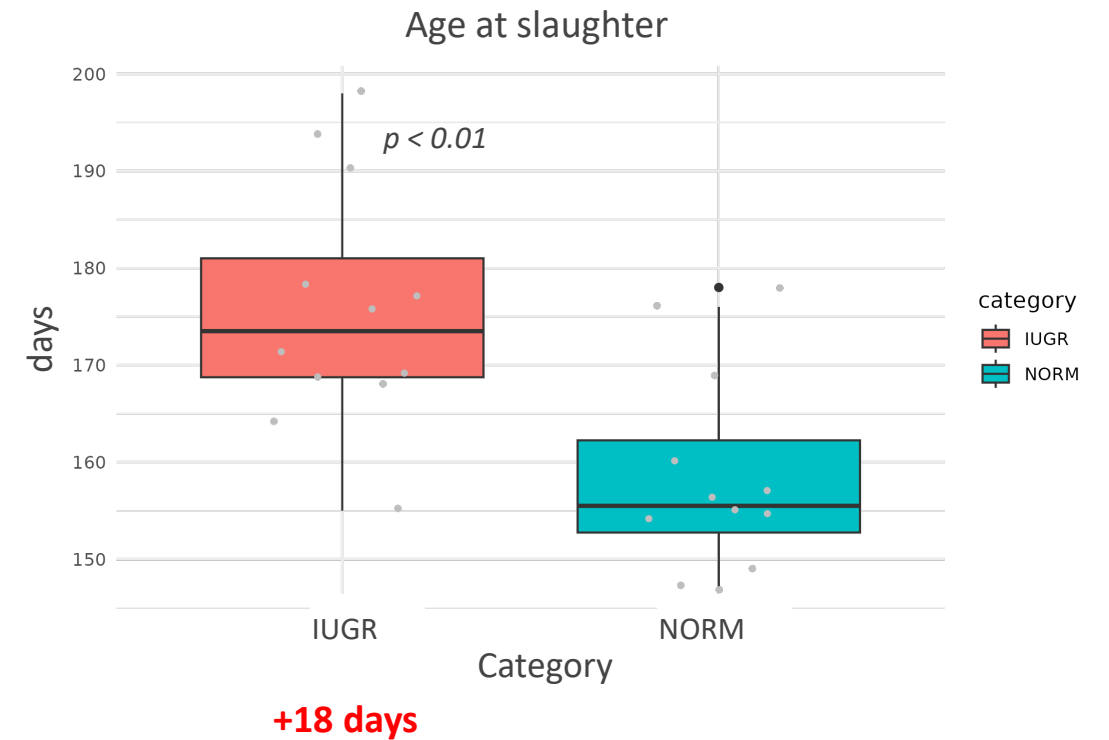
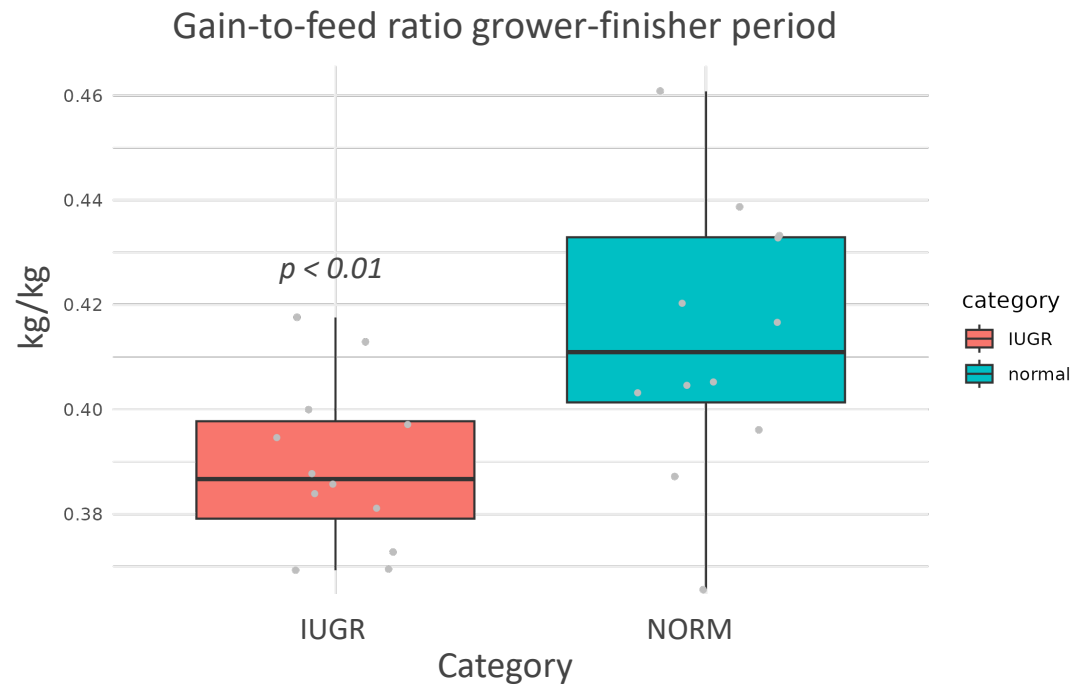


- ☐ Metabolite concentrations
Student's t -test, non-parametric Mann–Whitney
- ☐ Unsupervised multivariate analysis
PCA
- ☐ Supervised multivariate analysis
OPLS-DA
- ☐ Metabolites of interest
Variable importance in the projection (VIP) >1.0 and absolute high loadings

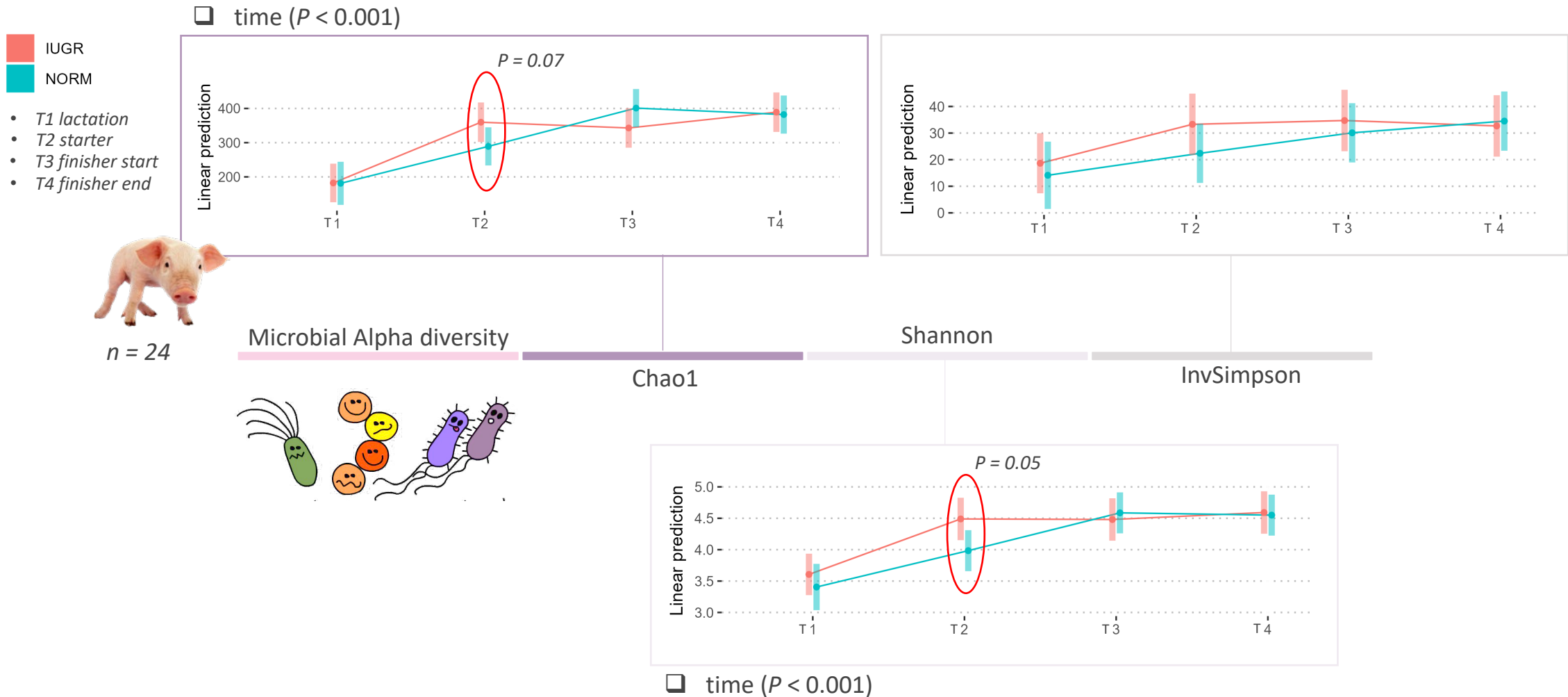
Results – growth performance



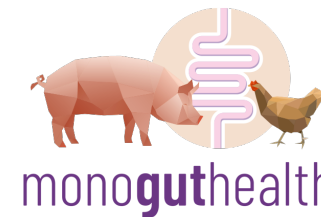
Results – growth performance



Results – faecal microbial Alpha diversity

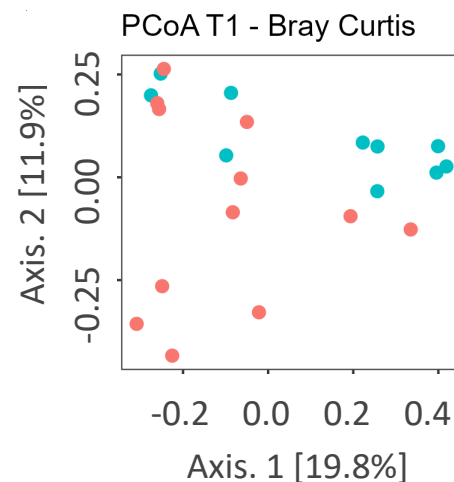


Results – faecal microbial Beta diversity



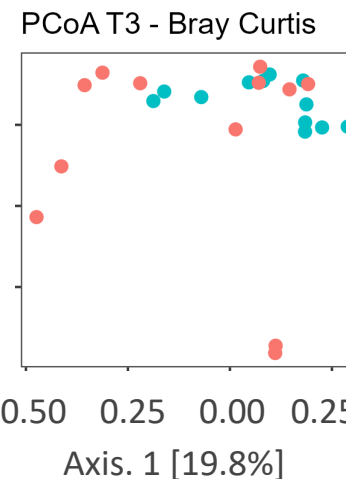
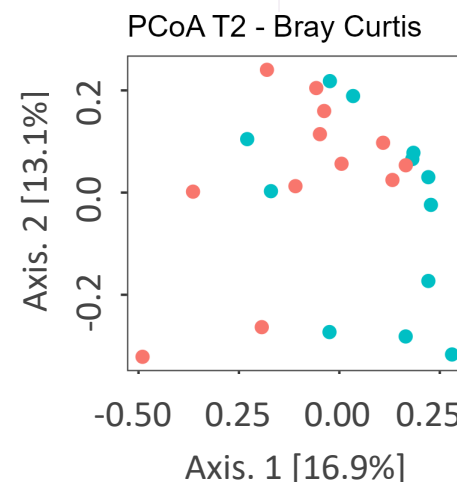
$n = 24$

Microbial Beta diversity



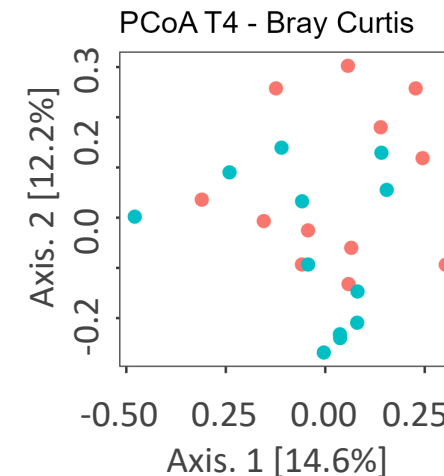
T1
Lactation

Starter
T2



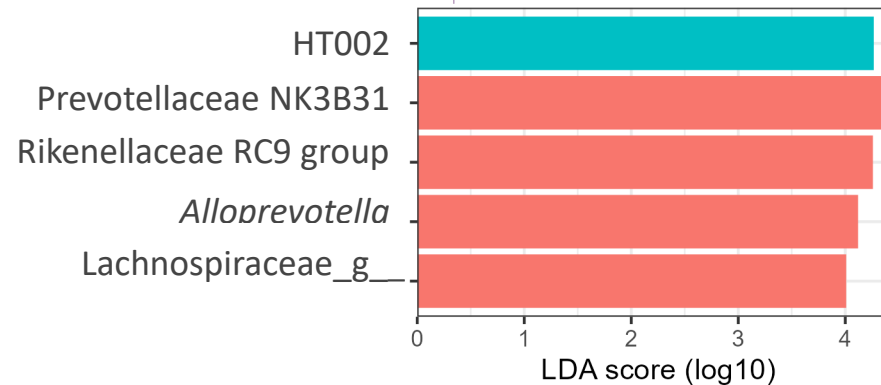
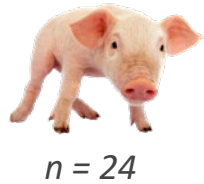
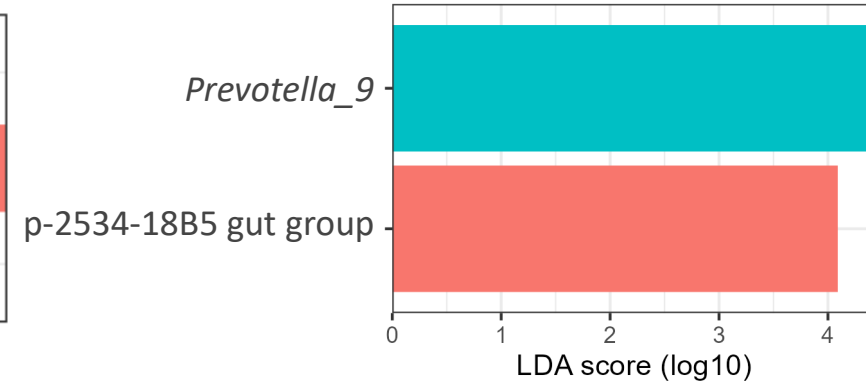
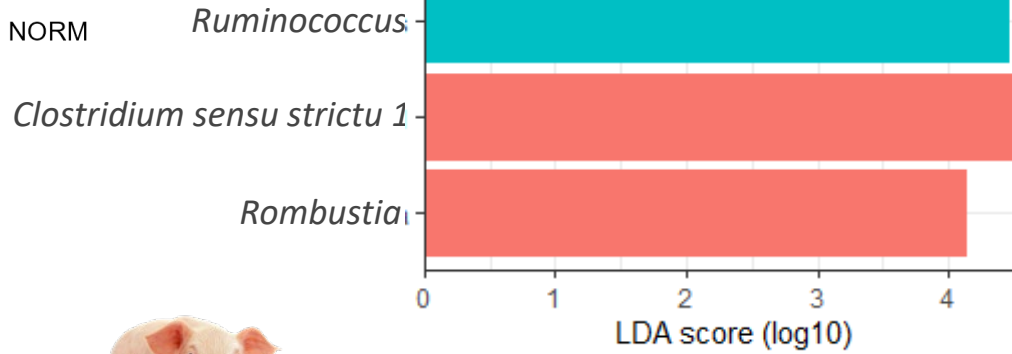
T3
Finisher start

Finisher end
T4



Results – differential analysis of taxa

Enriched group



Results – metabolome profile at T1

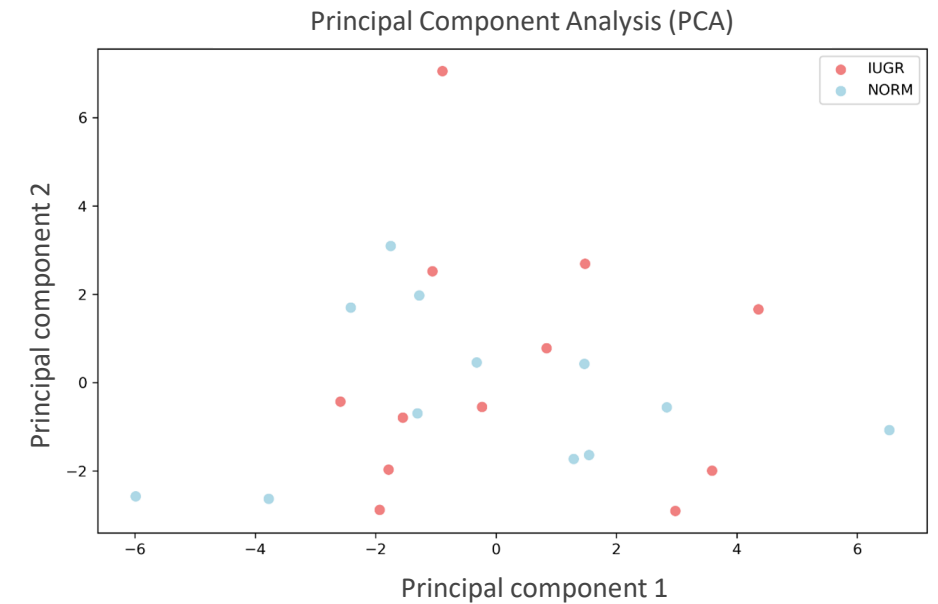


$n = 24$

- None of the metabolites was significantly different between IUGR and NORM pigs

- None of the metabolites showed a VIP > 1.0 in the OPLS-DA

- PCA analysis showed no spontaneous sample grouping



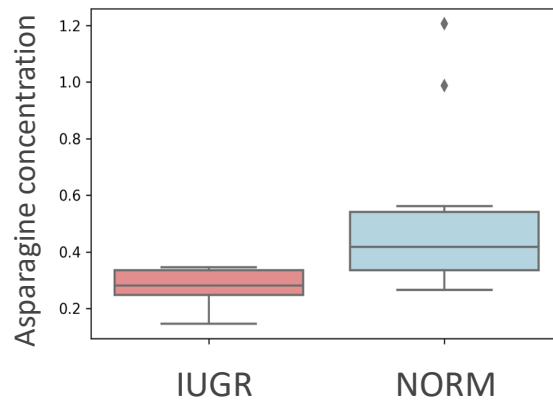
Results – metabolome profile at T2

- ❑ Asparagine was significantly lower in IUGR compared to NORM pigs

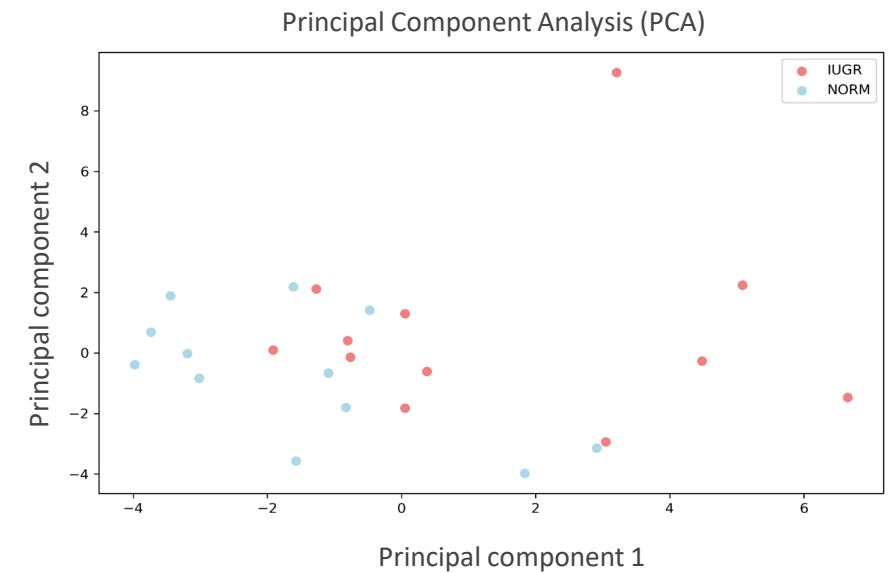
- ❑ None of the metabolites showed a VIP > 1.0 in the OPLS-DA



$n = 24$

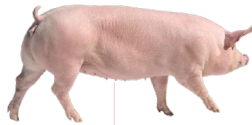


- ❑ PCA analysis showed a tendency for spontaneous sample grouping



Discussion

Growth restriction in the uterus has a negative effect on the **average daily gain**

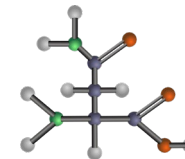


IUGR pigs showed lower abundances of **beneficial bacteria**

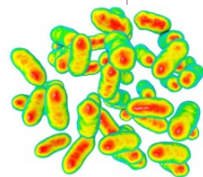


T1 Runimococcus
T2 Lactobacillaceae
T3 Prevotella

Asparagine was significantly lower in IUGR compared to NORM pigs in the starter period



IUGR has a long-lasting impact on the **fecal microbiota composition**



IUGR did not affect the plasma metabolomics in the **lactation period**



Identifying **biomarkers** can facilitate **early treatment**



THANK YOU

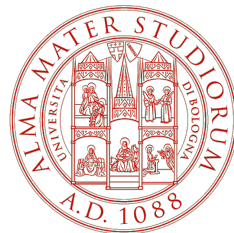
Do you have any questions?

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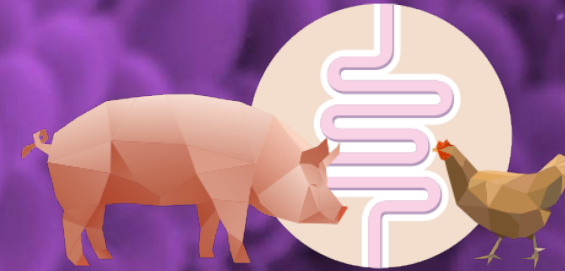
Website: ESR1: What are IUGR pigs? – phenotypic and metabolic differentiation - MonoGutHealth



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



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