

Broiler breeder female body weight optimization

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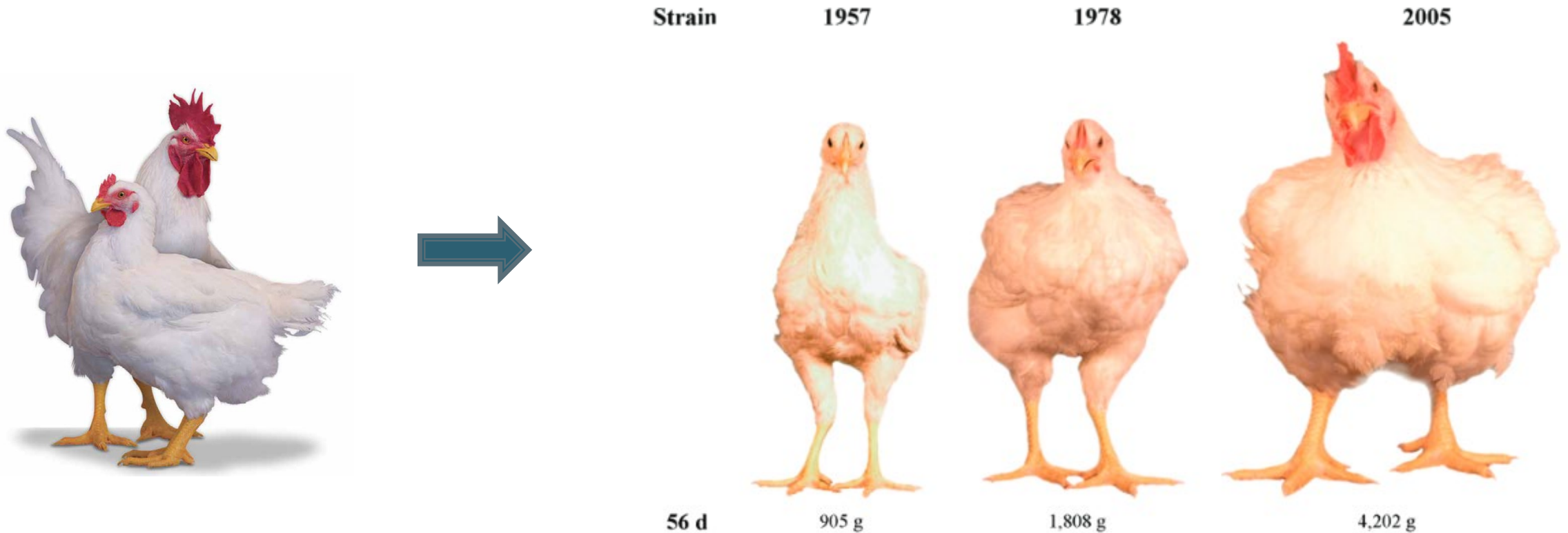
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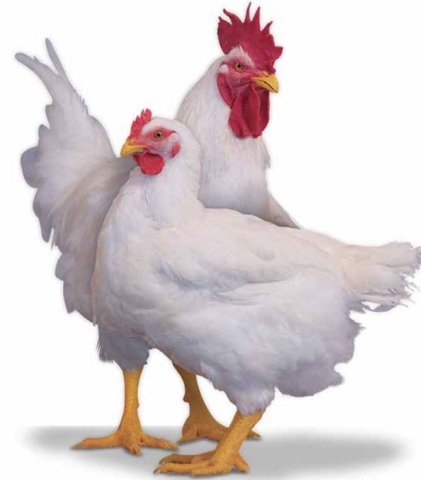
Introduction

- Growth and efficiency of broilers

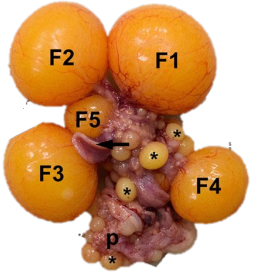


Introduction

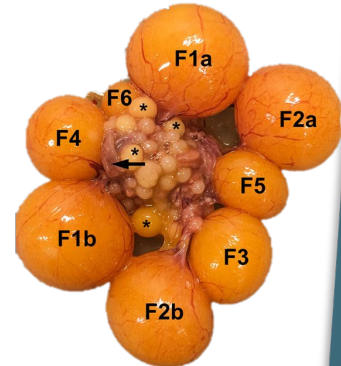
- Genetic selection for growth
- Overfeeding broiler breeders
- Control body weight (**BW**)
 - Restriction feed intake
- Growth trajectories
 - Recommendations by primary breeders



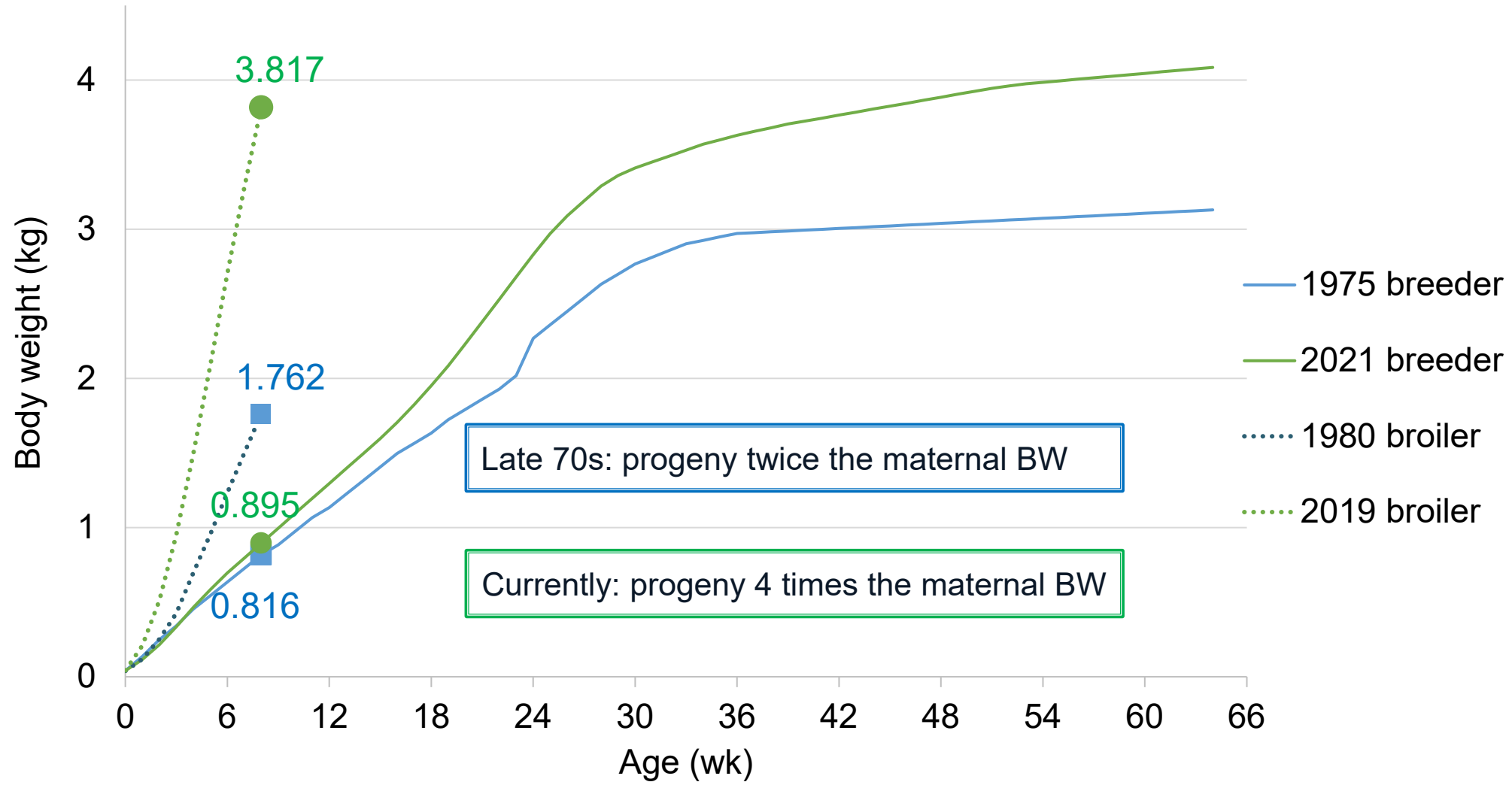
Feed restricted



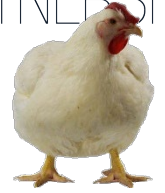
Overfed



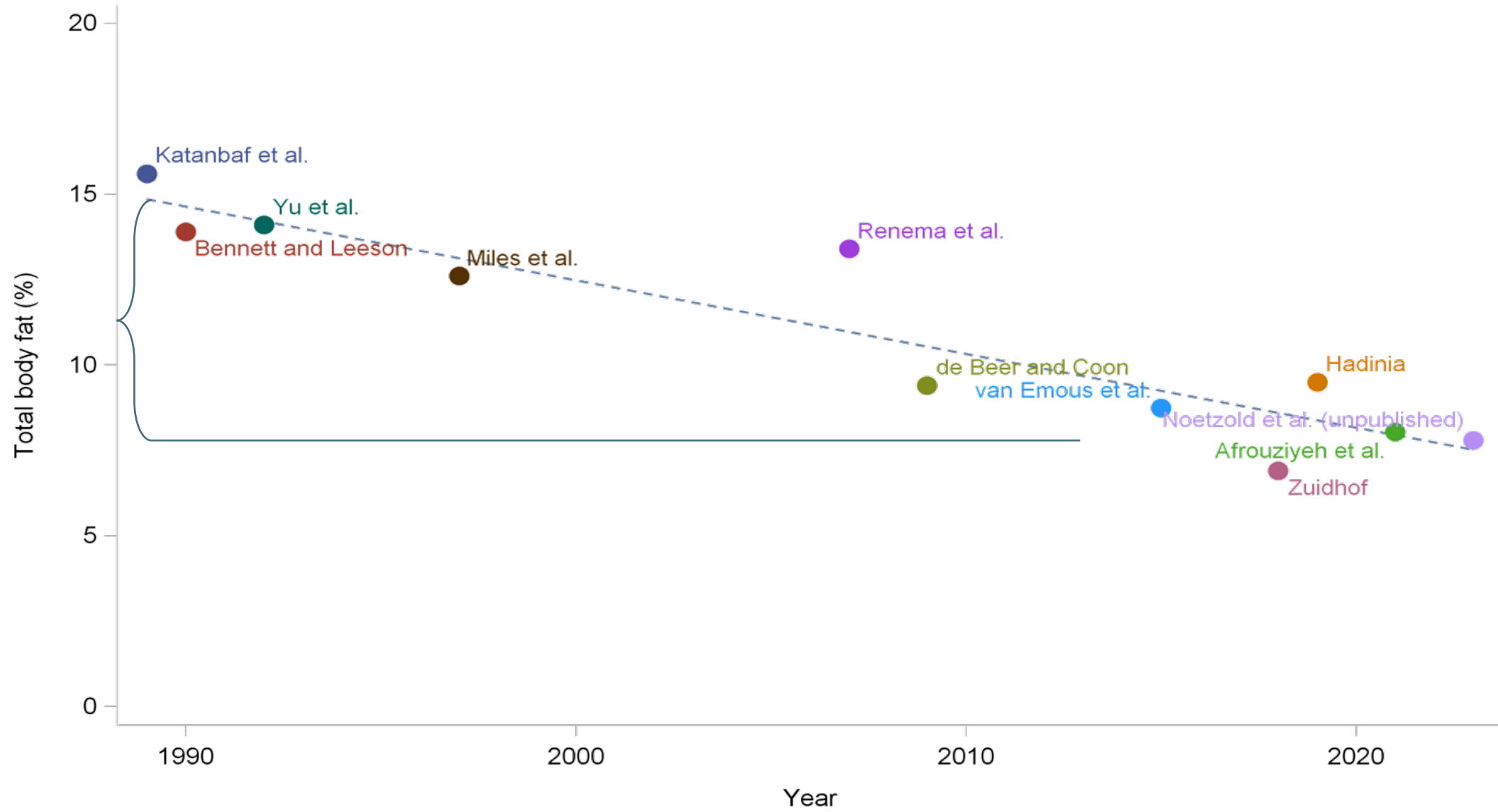
Growth trajectories evolution



Adapted from breeder guidelines



Broiler breeder body fat dropped 50% in 30 years



Carcass fat (%) at photostimulation age

Feed restriction & BW condition

- Too lean birds did not mature sexually

van der Klein et al., 2018; Zuidhof et al., 2018

- Full fed pullets laid first egg before photostimulation

*Zukiwsky et al., 2021; Carney et al., 2022
Noetzold et al., 2022 (Unpublished)*

- Metabolic control related to sexual maturation?

van der Klein et al., 2018; Hanlon et al., 2020; Shi et al., 2020

Objectives

- Evaluate the effect of different BW growth trajectories on:
 - Feed efficiency
 - Fat deposition
 - Abdominal fat pad and total carcass fat
 - Reproductive performance
 - BW and uniformity of conventional (**CON**) vs precision feeding system (**PFS**)

Hypotheses

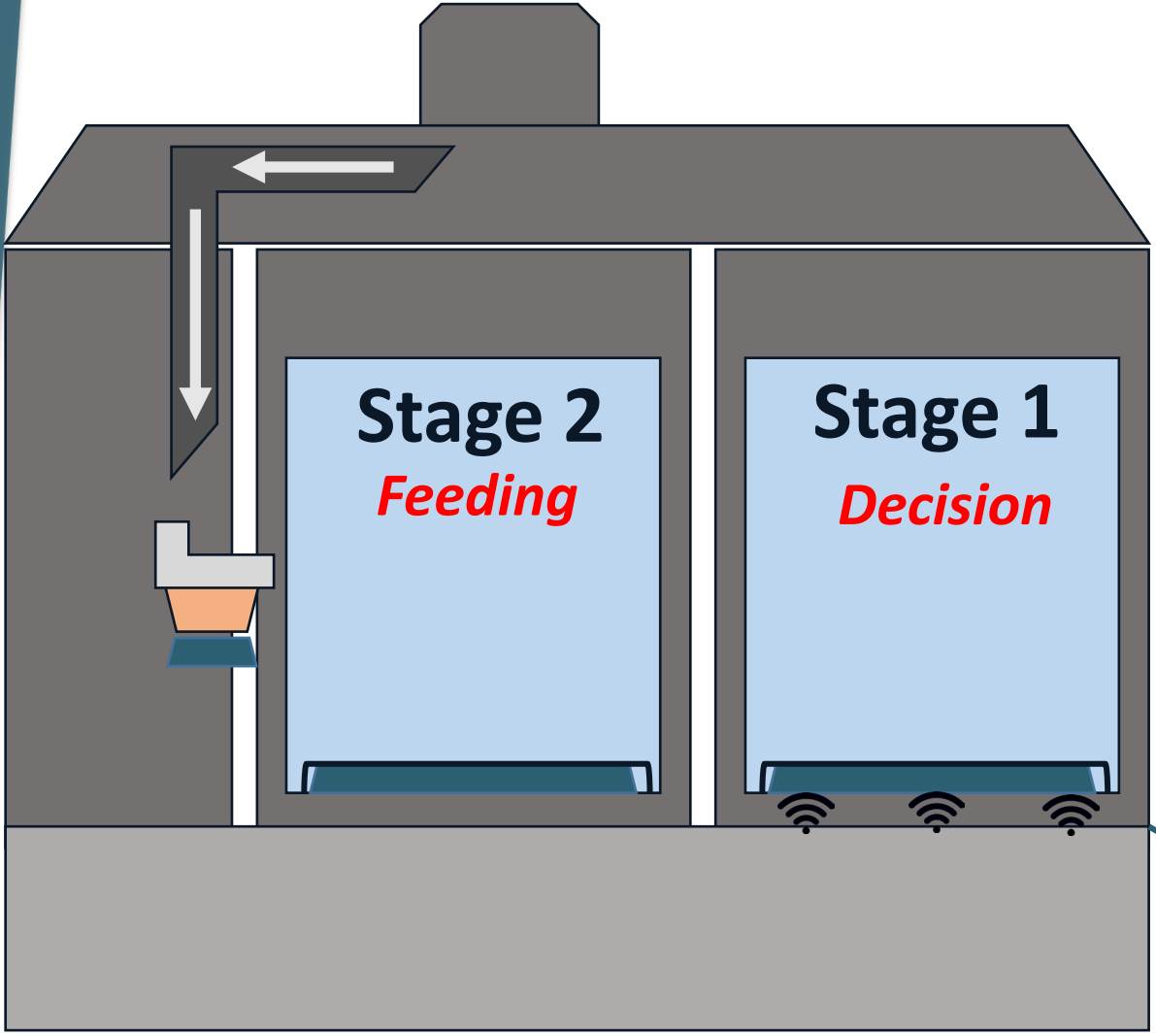
- We hypothesized that early growth and advanced pubertal growth would increase:
 - Fat deposition
 - Feed conversion ratio (FCR)
 - Advance sexual maturation
- CON vs PFS comparison:
 - Higher uniformity and fertility on the PFS

Material and methods - Breeders

- Strain: Ross 308
- 2 concurrent trials using a precision feeding system
- Each trial
 - Factorial 6 x 2 (12 growth curves per exp)
 - 24 birds per curve



How does the system work?



Radio identification ID (RFID)



```
graph TD; A[Bird enters the station] --> B[Door closes behind the bird]; B --> C[Body weight is recorded]; C --> D{Does bird weigh less than the target weight?}; D -- Yes --> E[Provides access to the feed]; D -- No --> F[Eject animal from station]; E --> F;
```

The flowchart describes the process: 1. Bird enters the station. 2. Door closes behind the bird. 3. Body weight is recorded. 4. Decision: Does bird weigh less than the target weight? - If Yes: Provides access to the feed. - If No: Eject animal from station. 5. Both paths lead to Eject animal from station.

Material and methods – Broiler breeders

- Diets:
 - 3 diets during rearing phase
 - Starter (0-28d)
 - Grower (29-133d)
 - Pre-Breeder (134 to 5% production)
 - Laying phase
 - Breeder 1, 2, and 3
- Birds were fed the same diets
- Dissections
 - 16, 21, 24, 28 and 32 wk (1 bird per growth curve)
 - Sexual maturation (first egg; 5 birds per curve)

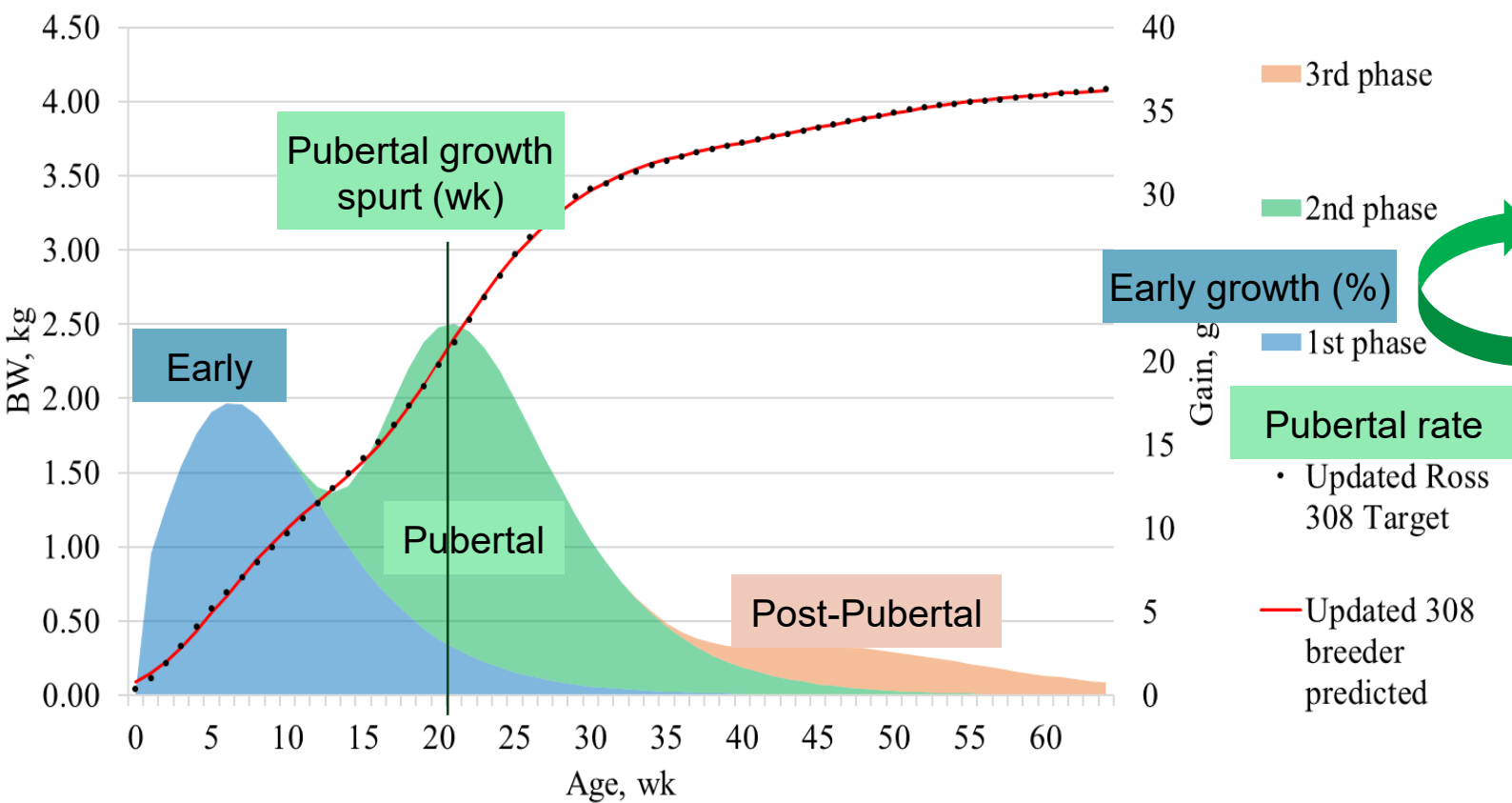


Material and methods - Breeders

- CON system
 - Ross 308 strain
 - Raised to the standard BW target
 - Fed once a day
 - Weekly BW record & feed allocations
-
- Objective: compare to the PFS standard 308 target



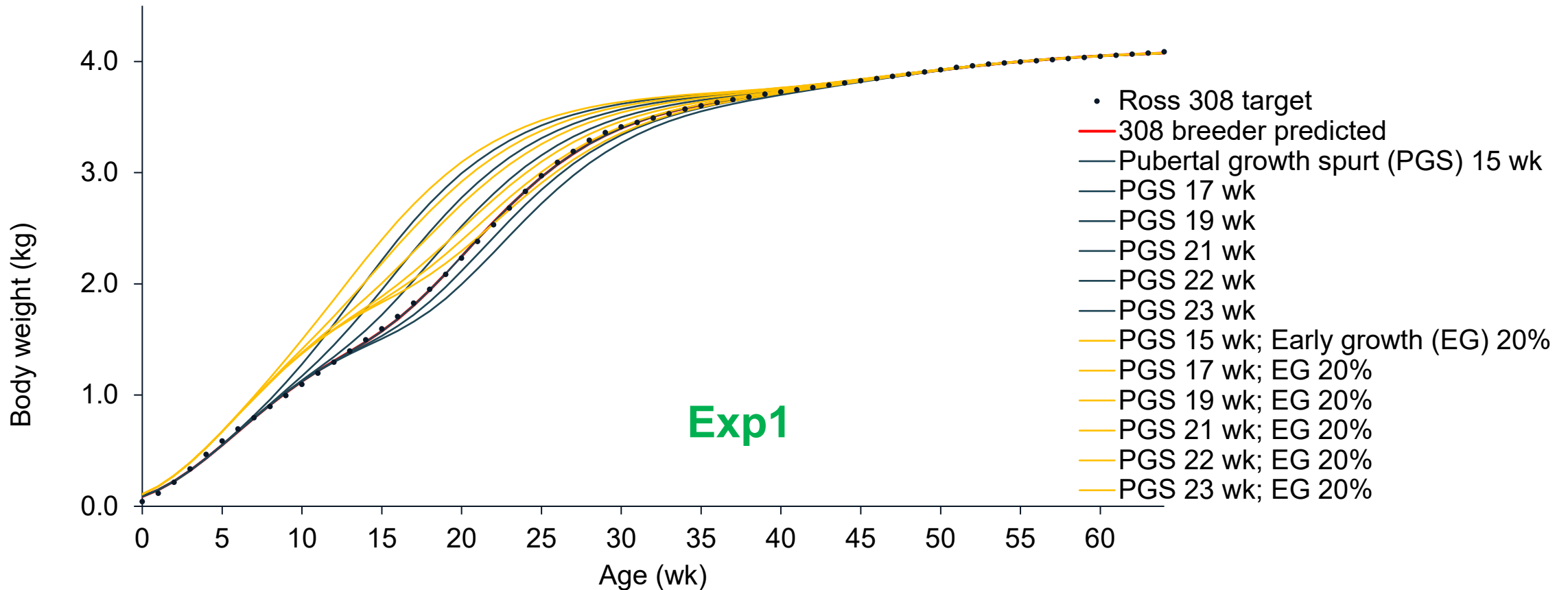
Growth trajectories development



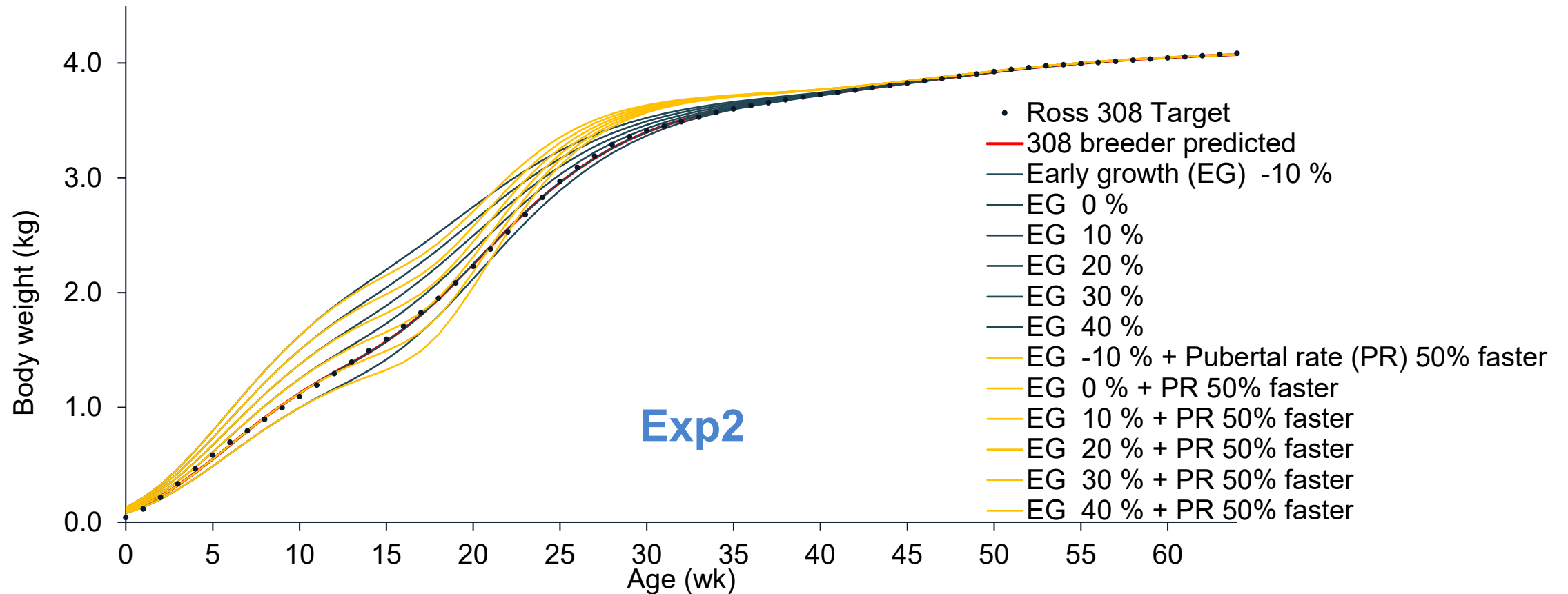
| Gompertz Model | | |
|----------------------------|--------------------|----|
| Parameters | Ross 308 predicted | |
| Gain (g_1) | 1.77 | kg |
| Rate of maturing (b_1) | 0.19 | |
| Inflection (l_1) | 5.8 | wk |
| g_2 | 1.98 | kg |
| b_2 | 0.19 | |
| l_2 | 21 | wk |
| g_3 | 0.37 | kg |
| b_3 | 0.13 | |
| l_3 | 47 | wk |

Zuidhof, 2020

| | | |
|----------------------------|----------|------------------|
| Early growth (%) | Standard | Early growth 20% |
| Pubertal growth spurt (wk) | | |
| Gain (g_1) | | |
| Rate of maturing (b_1) | | |
| Inflection (l_1), | | |
| g_2 | | |
| b_2 | | |
| l_2 | | |

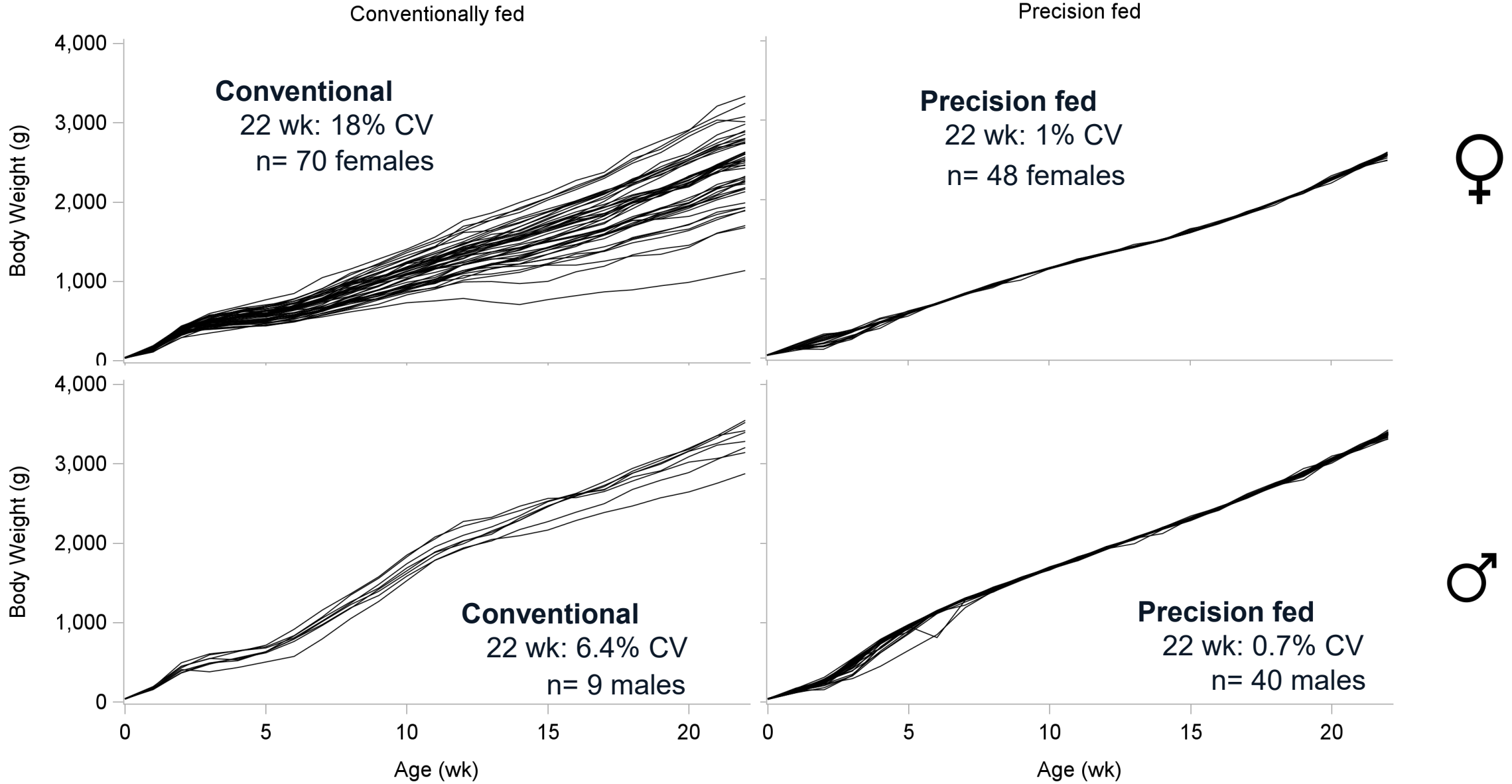


| | | |
|----------------------------|----------|-------------|
| Pubertal growth rate | Standard | 50 % faster |
| Early growth (%) | | |
| Gain (g_1) | | |
| Rate of maturing (b_1) | | |
| Inflection (l_1) | | |
| g_2 | | |
| b_2 | | |
| l_2 | | |

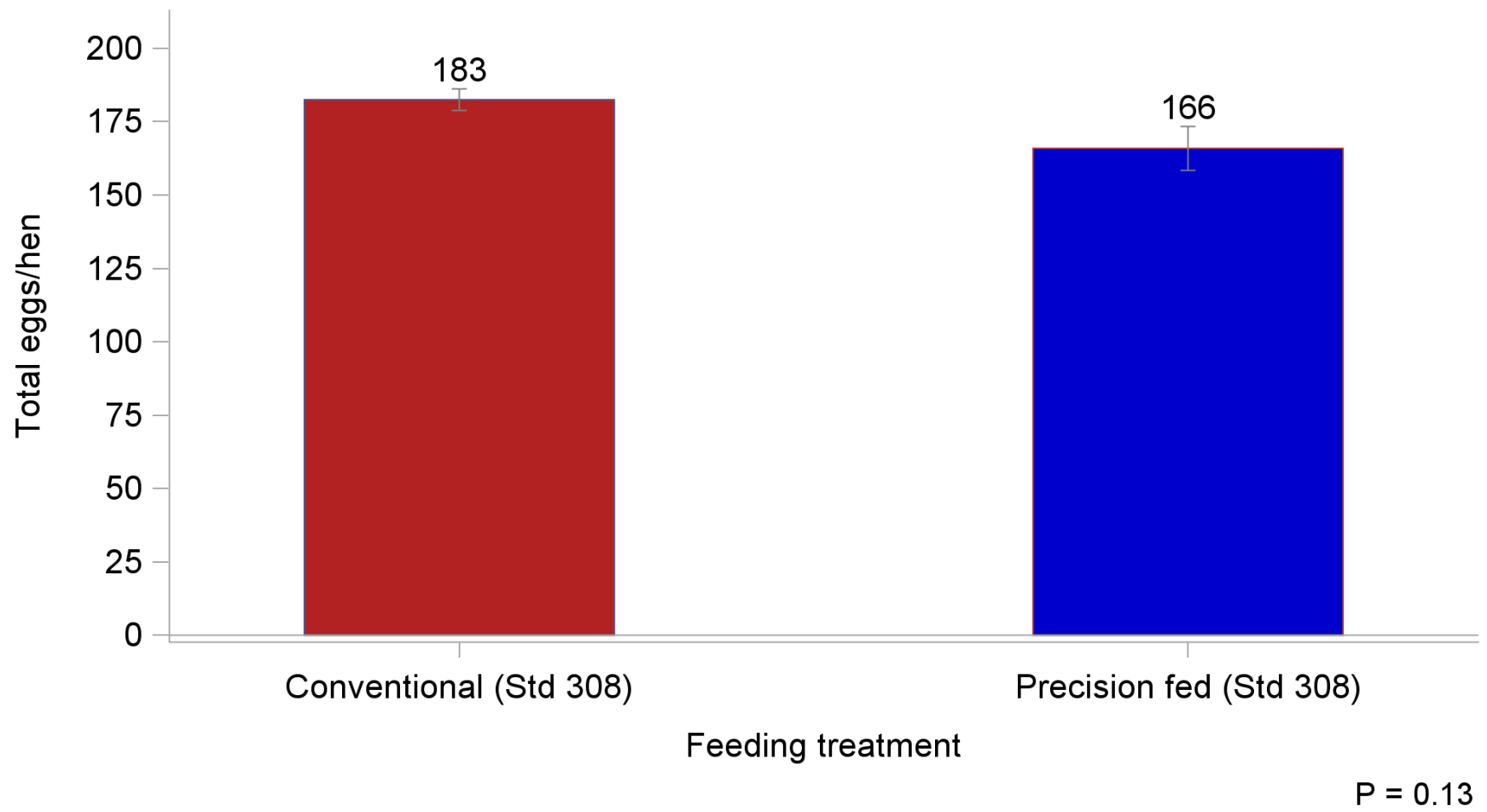


Results

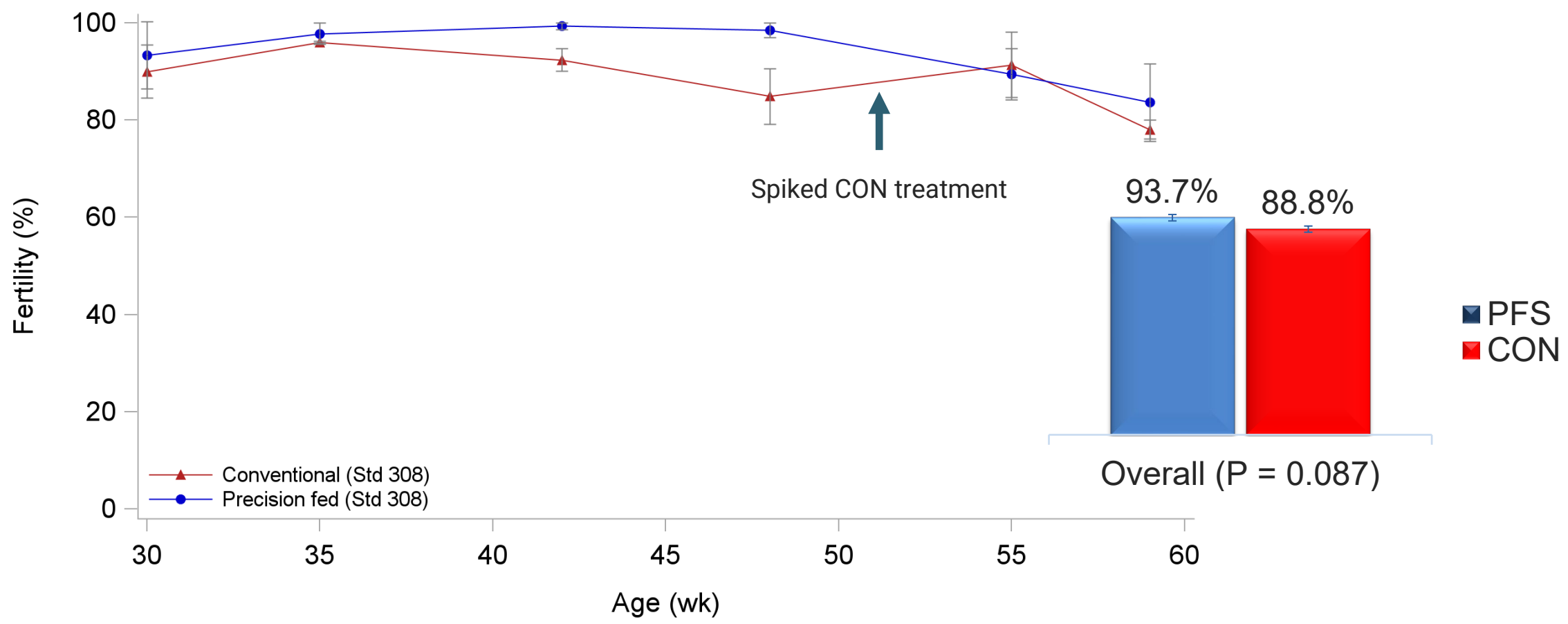
PFS vs. CON body weight



Total egg production PFS vs. CON

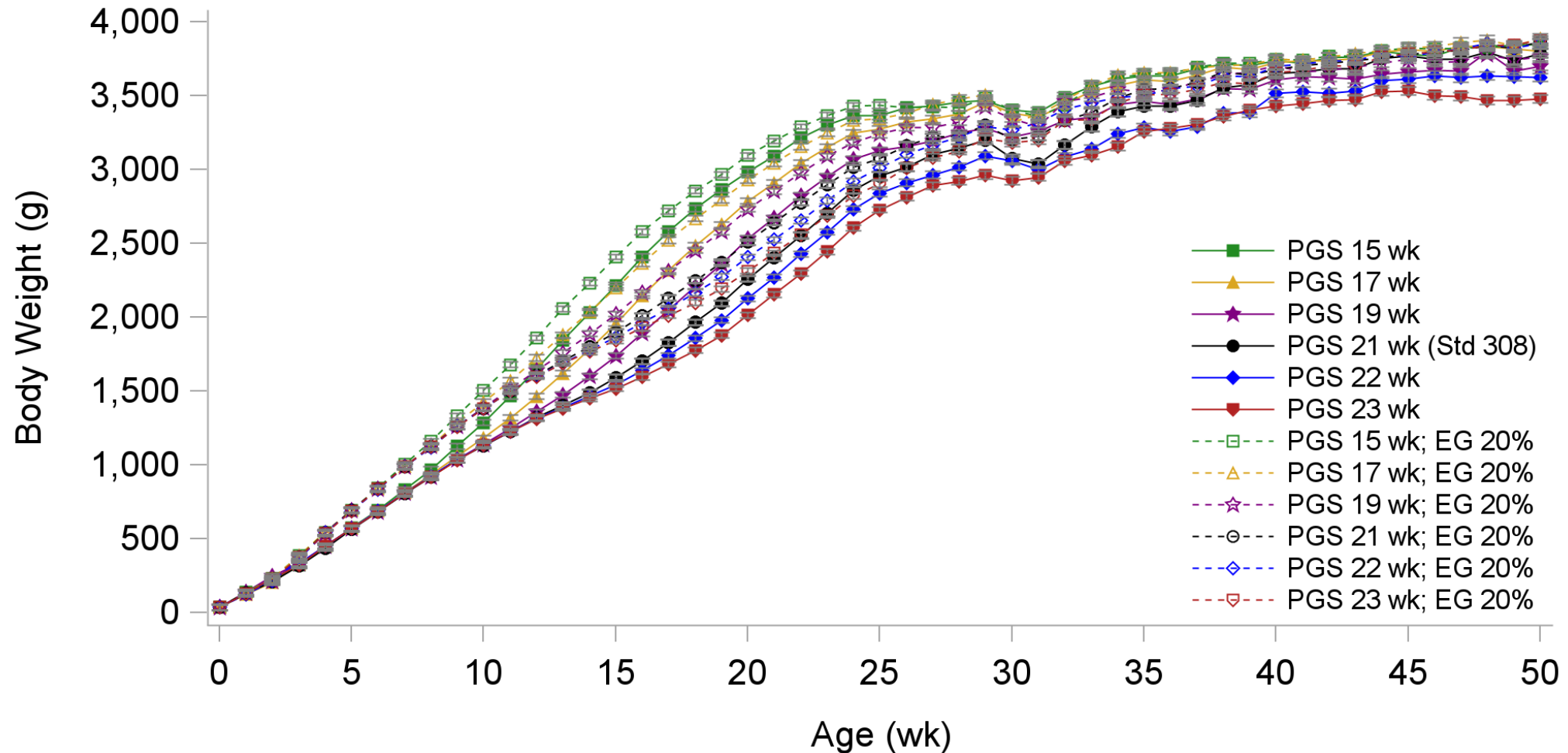


PFS vs. CON fertility



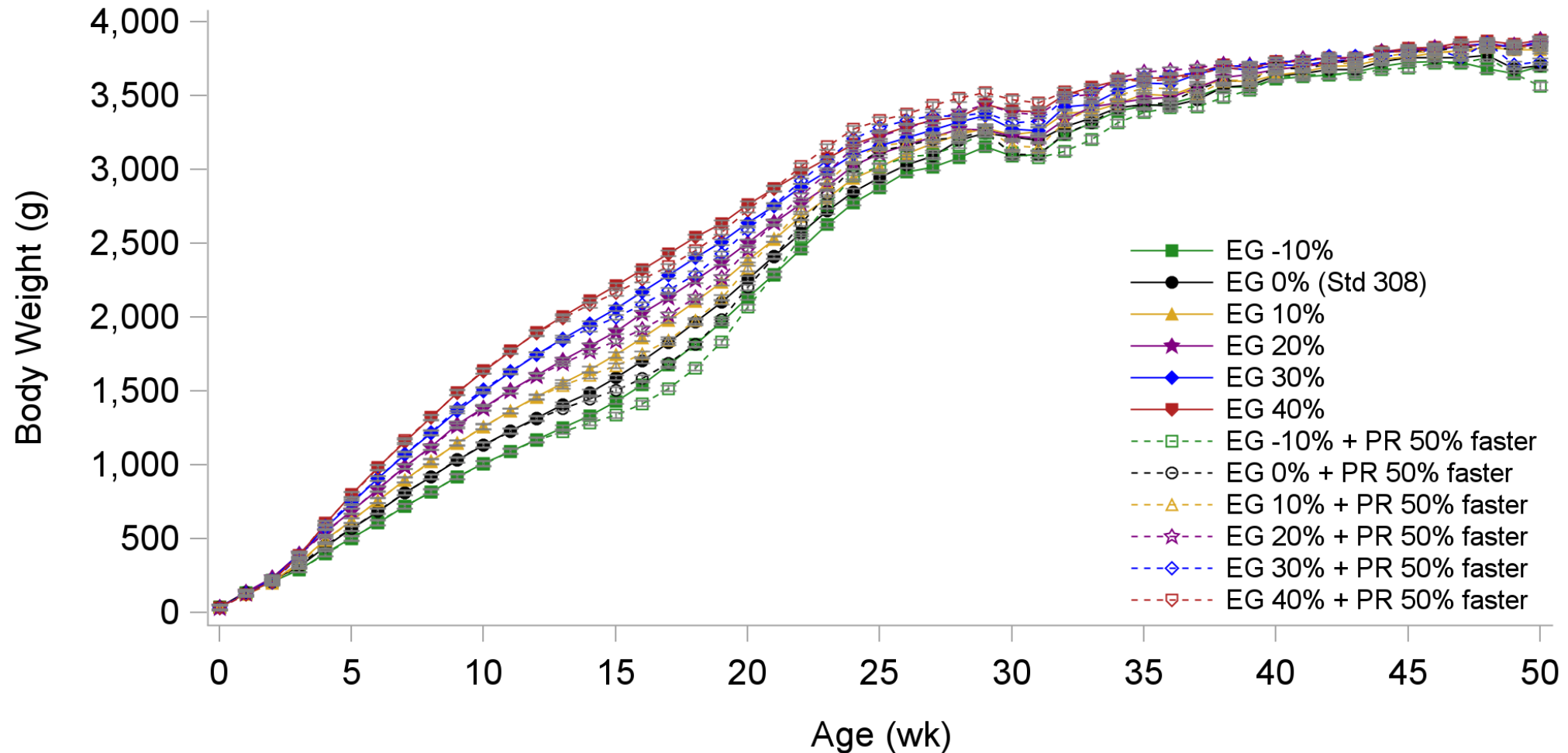
Body weight Exp1

Study: Exp1



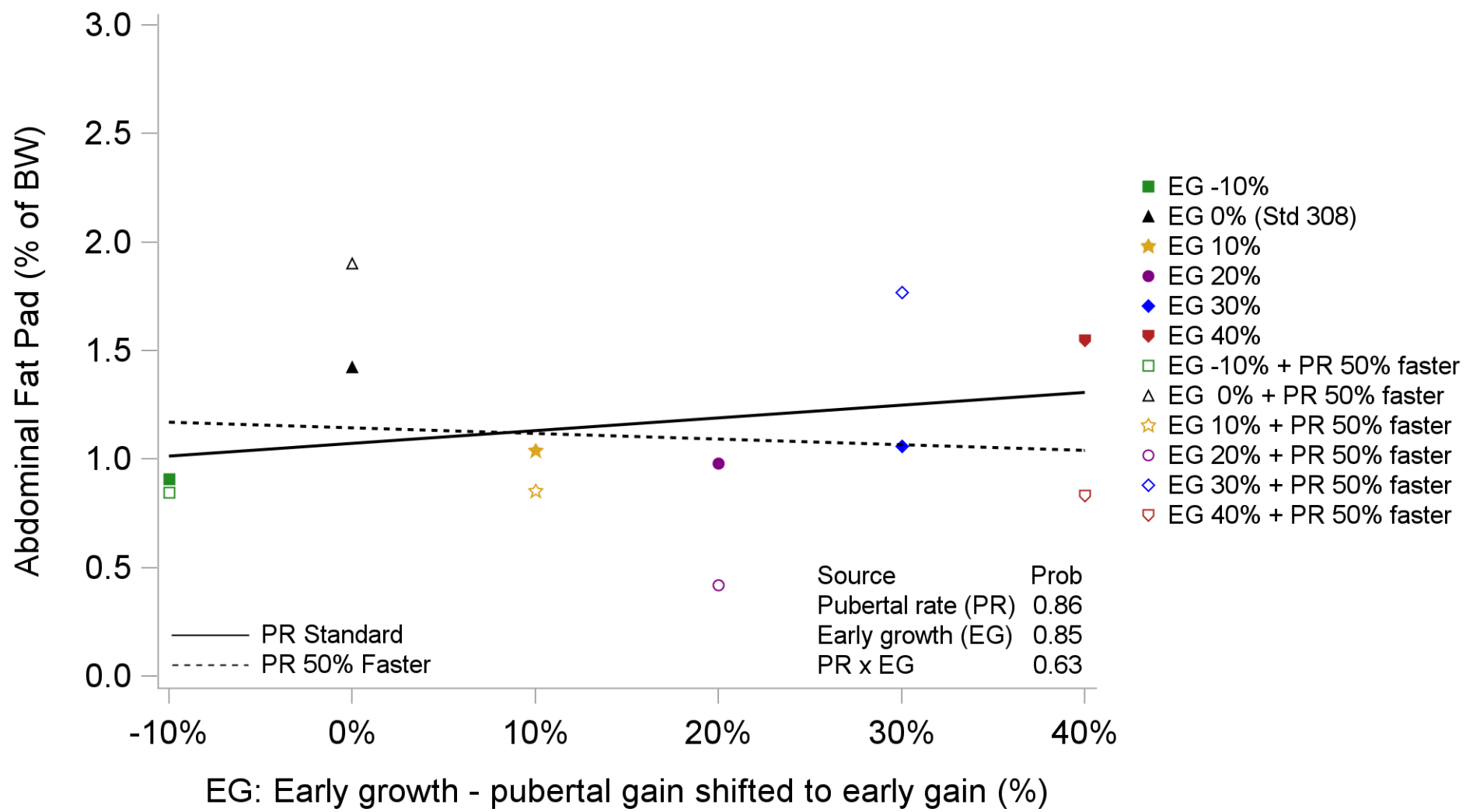
Body weight Exp2

Study: Exp2



Abdominal fat pad at 21 wk

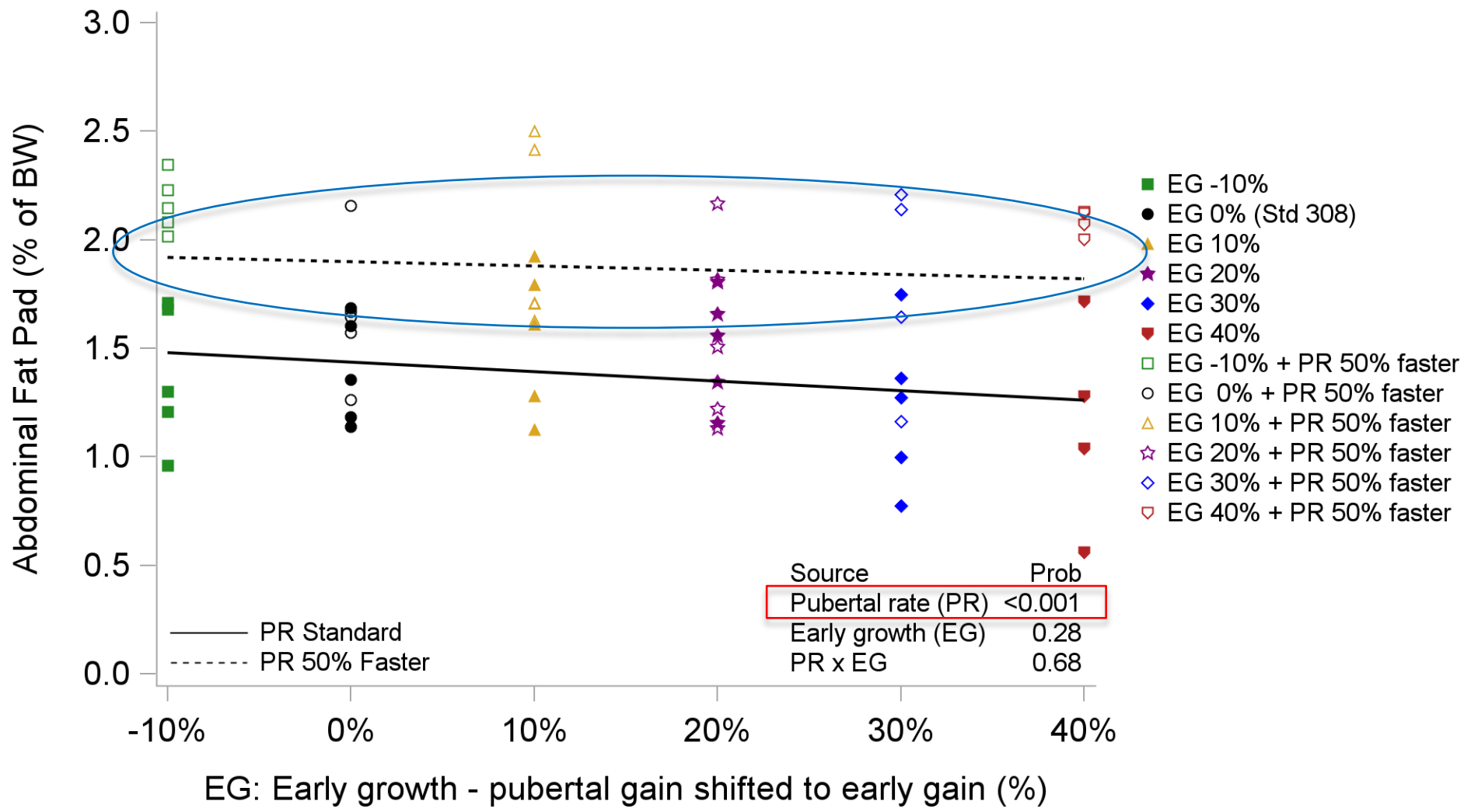
Exp2



| | |
|--------------------|------|
| Source | Prob |
| Pubertal rate (PR) | 0.86 |
| Early growth (EG) | 0.85 |
| PR x EG | 0.63 |

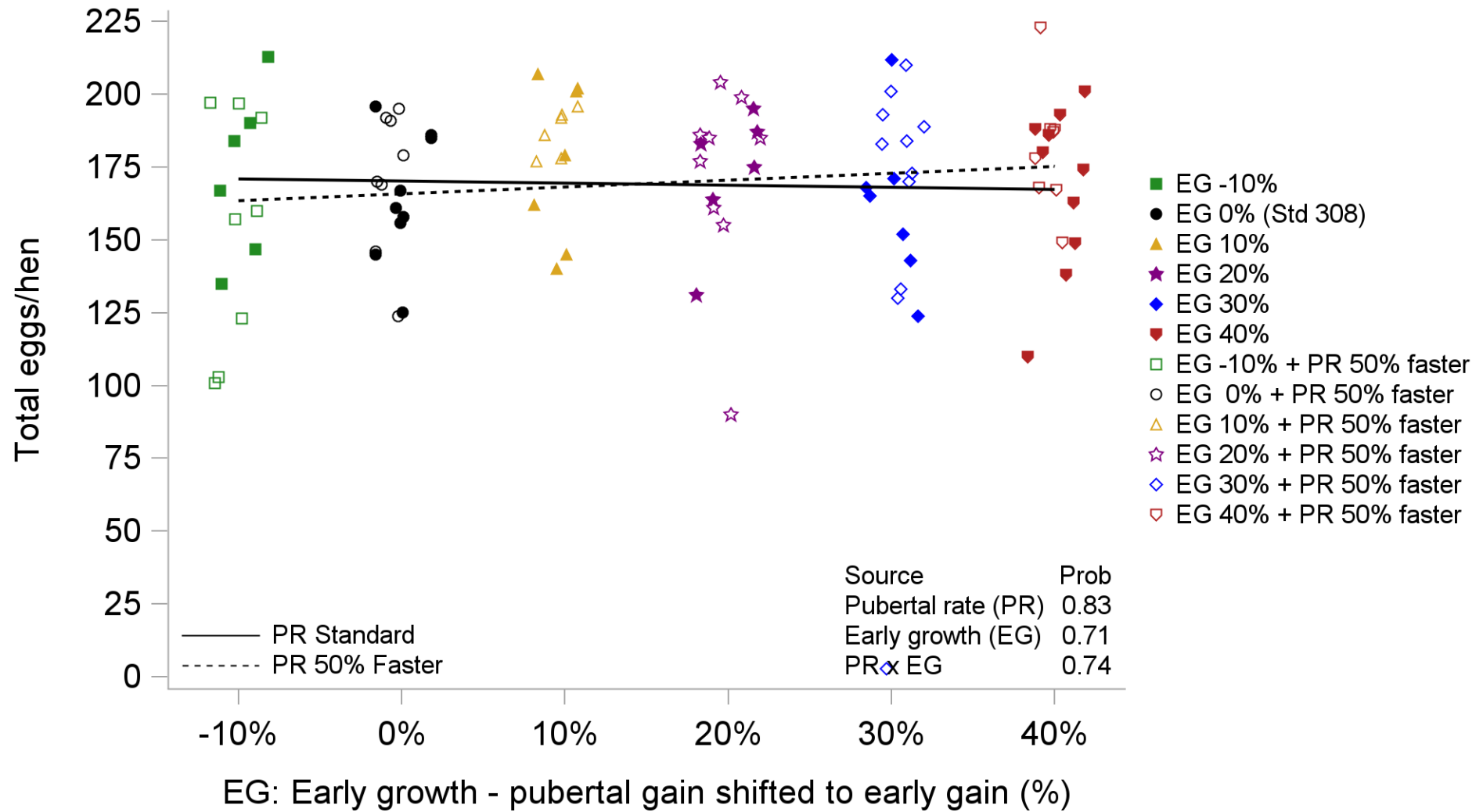
Abdominal fat pad at sexual maturation

Exp2



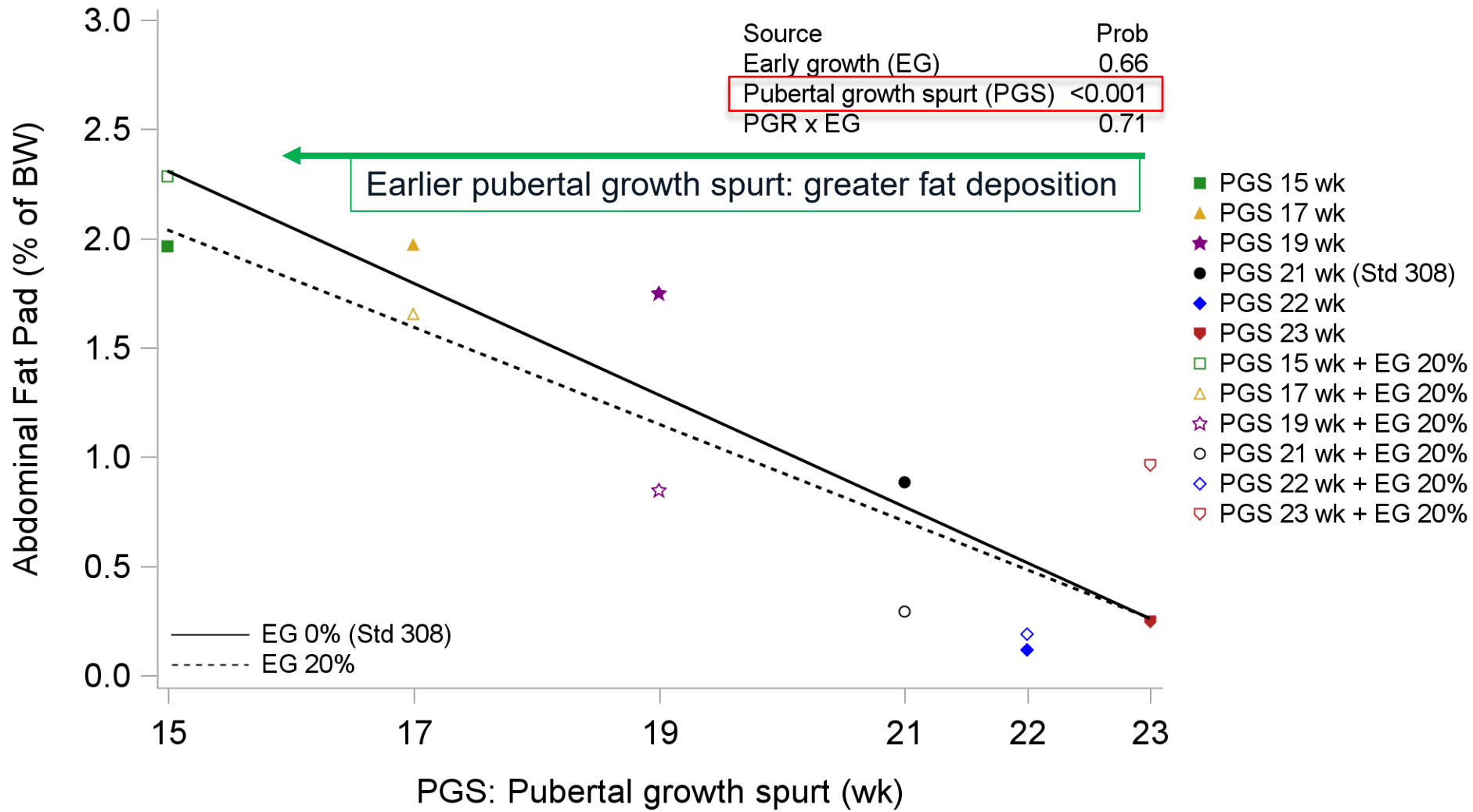
Egg production to 60 wk of age

Exp2



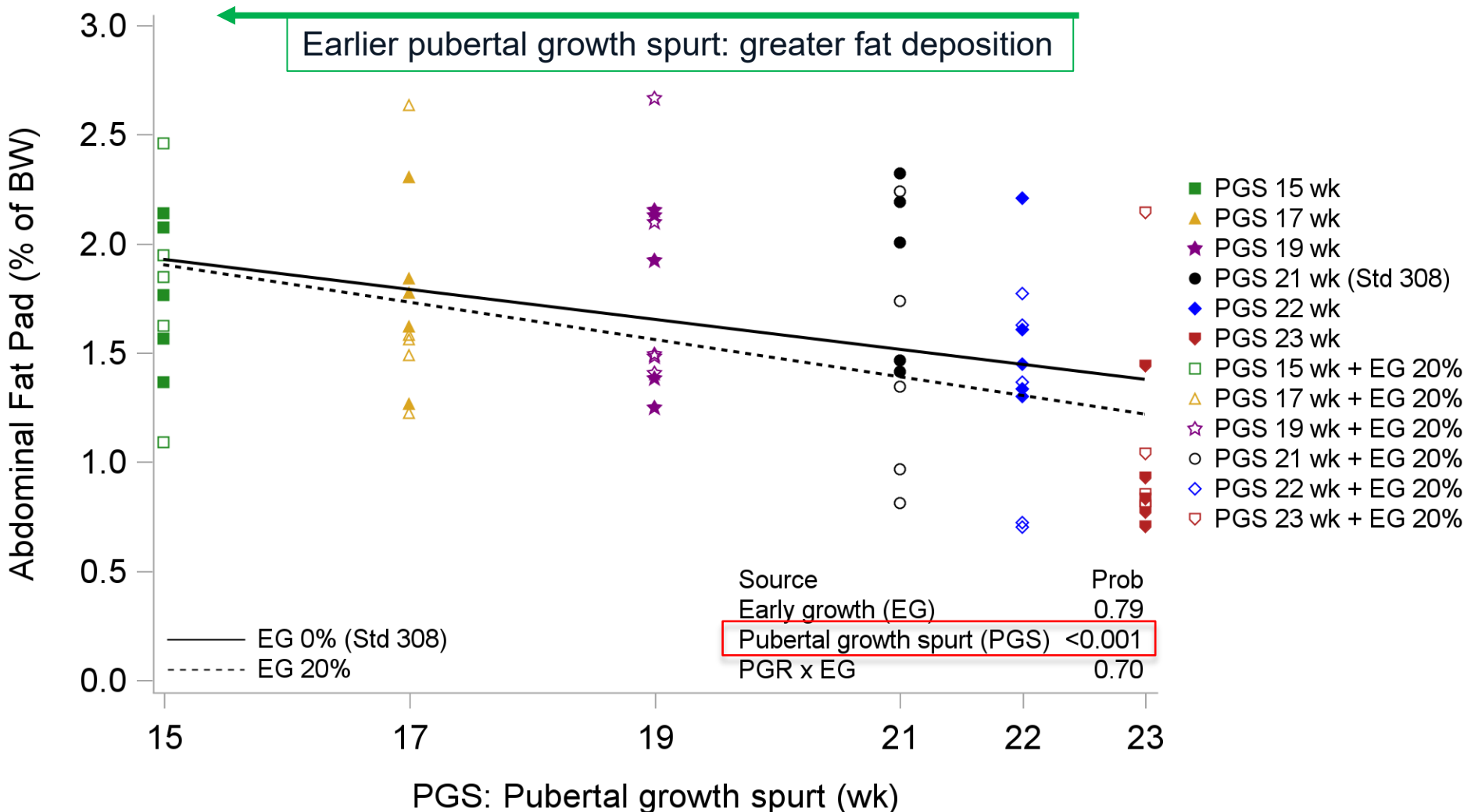
Abdominal fat pad at 21 wk

Exp1



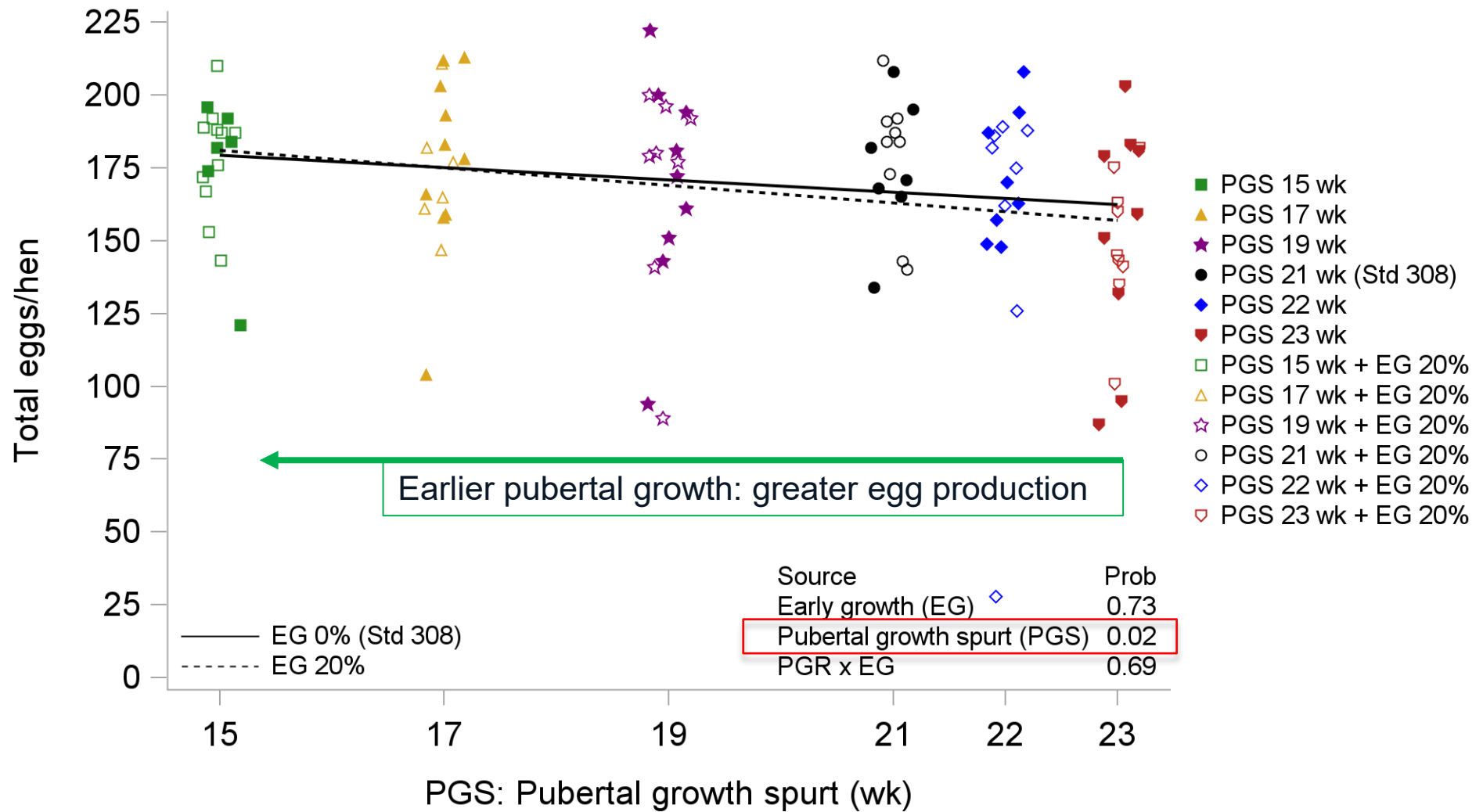
Abdominal fat pad at sexual maturation

Exp1



Egg production to 60 wk of age

Exp1



Summary

| | Experiment 1 | | Experiment 2 | |
|---------------------------|--|--|--|--|
| | Advance Pubertal Growth spurt (continuous) | Shift growth to earlier phase (0 or 20%) | Shift growth to earlier phase (continuous) | Rate of pubertal growth phase (normal or fast) |
| Abdominal fat (21 wk) | *** | - | - | - |
| Abdominal fat (First egg) | *** | - | - | *** |
| Egg production | * | - | - | - |
| FCR | - | * | * | - |

*** $P \leq 0.001$

* $P \leq 0.05$

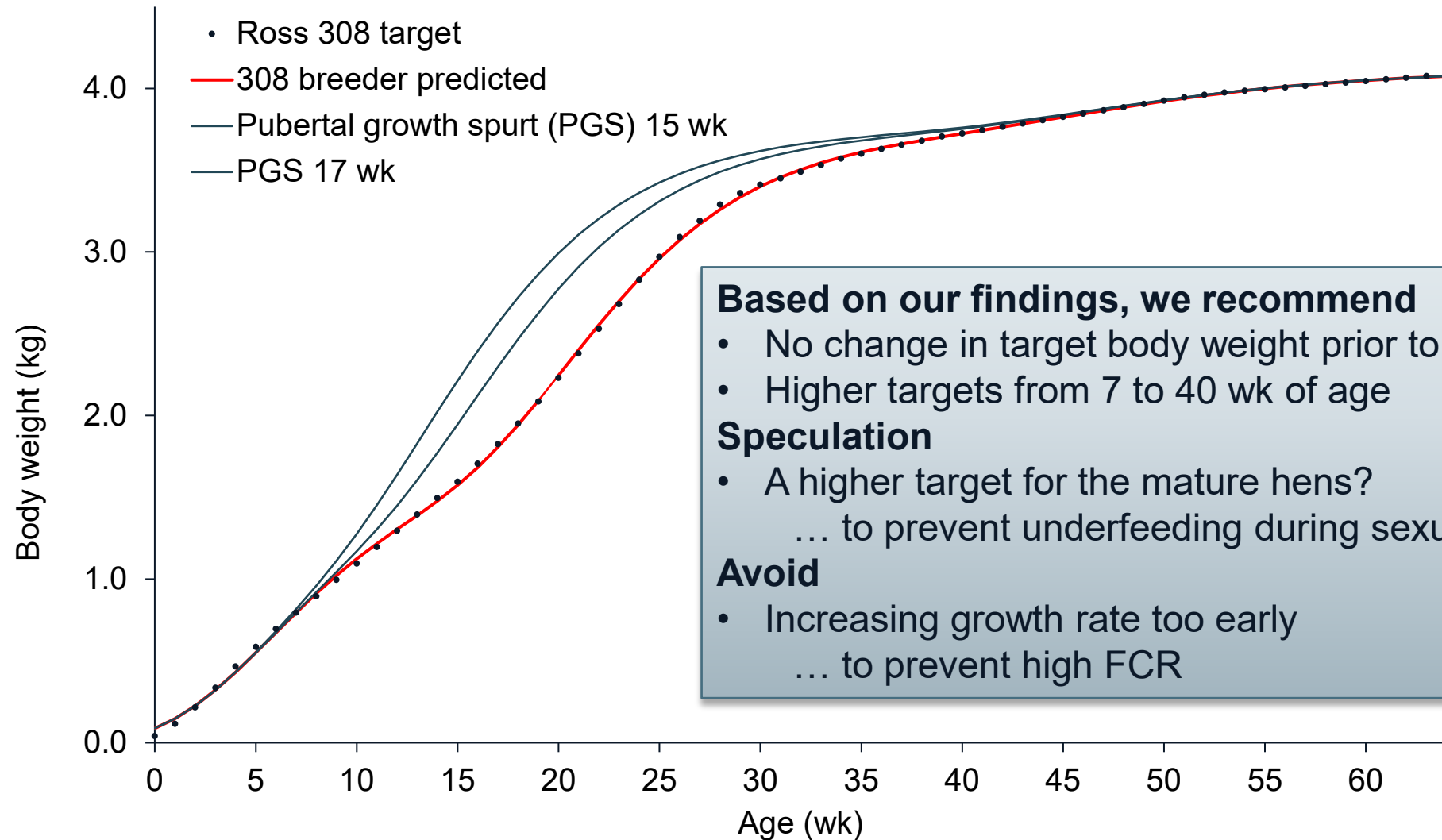
- Not significant

Key Conclusions

- Abdominal fat pad at 21 wk was the most important predictor of reproductive efficiency
- Advancing the timing of the pubertal growth spurt increased
 - Abdominal fat at photostimulation
 - Abdominal fat at first egg
 - Egg production
- Shifting growth from phase 2 to phase 1 increased FCR, with no increase in egg production



Practical Recommendation



Based on our findings, we recommend

- No change in target body weight prior to 7 wk of age
- Higher targets from 7 to 40 wk of age

Speculation

- A higher target for the mature hens?
... to prevent underfeeding during sexual maturation

Avoid

- Increasing growth rate too early
... to prevent high FCR

Future of the PF system

- Right feed, right amount, right bird, at the right time
- 1st commercialization (males)
 - GP, GGP and Pedigree
 - Females?



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Association canadienne des producteurs d'oeufs d'incubation de poulet à chair



Canadian Poultry
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Du Canada



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Thank you!

