

Broiler genetic selection through the decades... and the consequences to broiler breeders

Valerie Carney, PhD
Innovation Showcase
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visionary

change

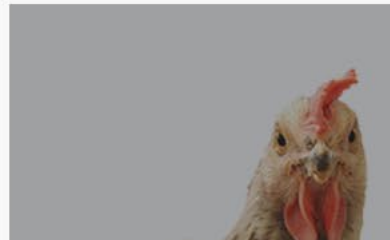
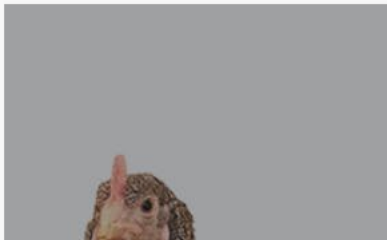
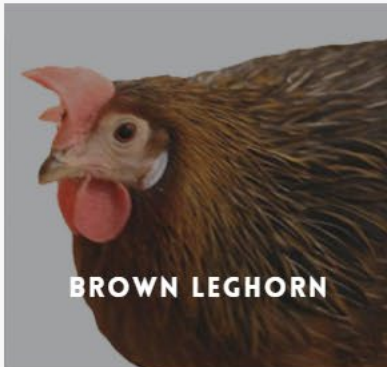
collaboration

opportunity

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BREEDS

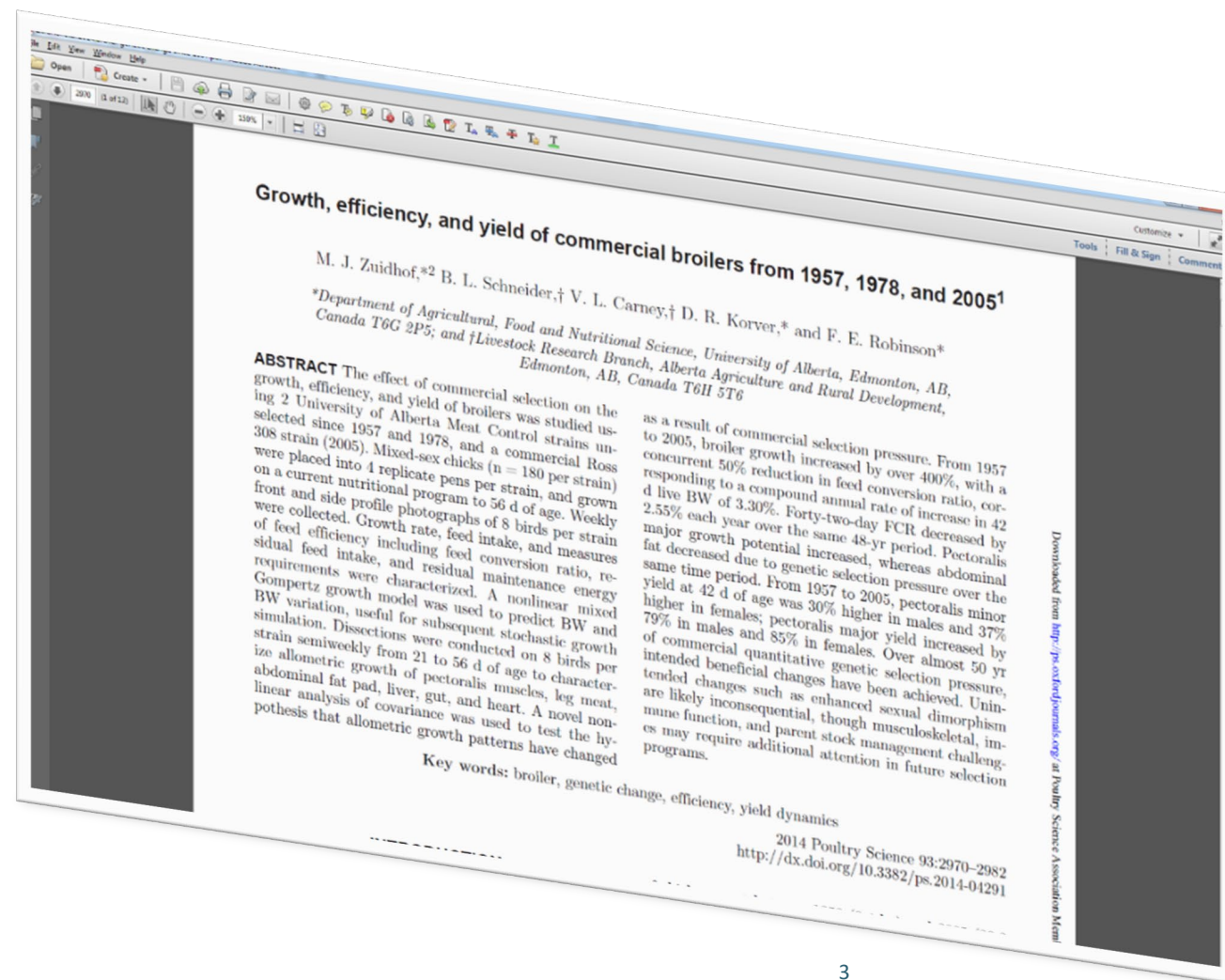
Our Fabulous Breeds



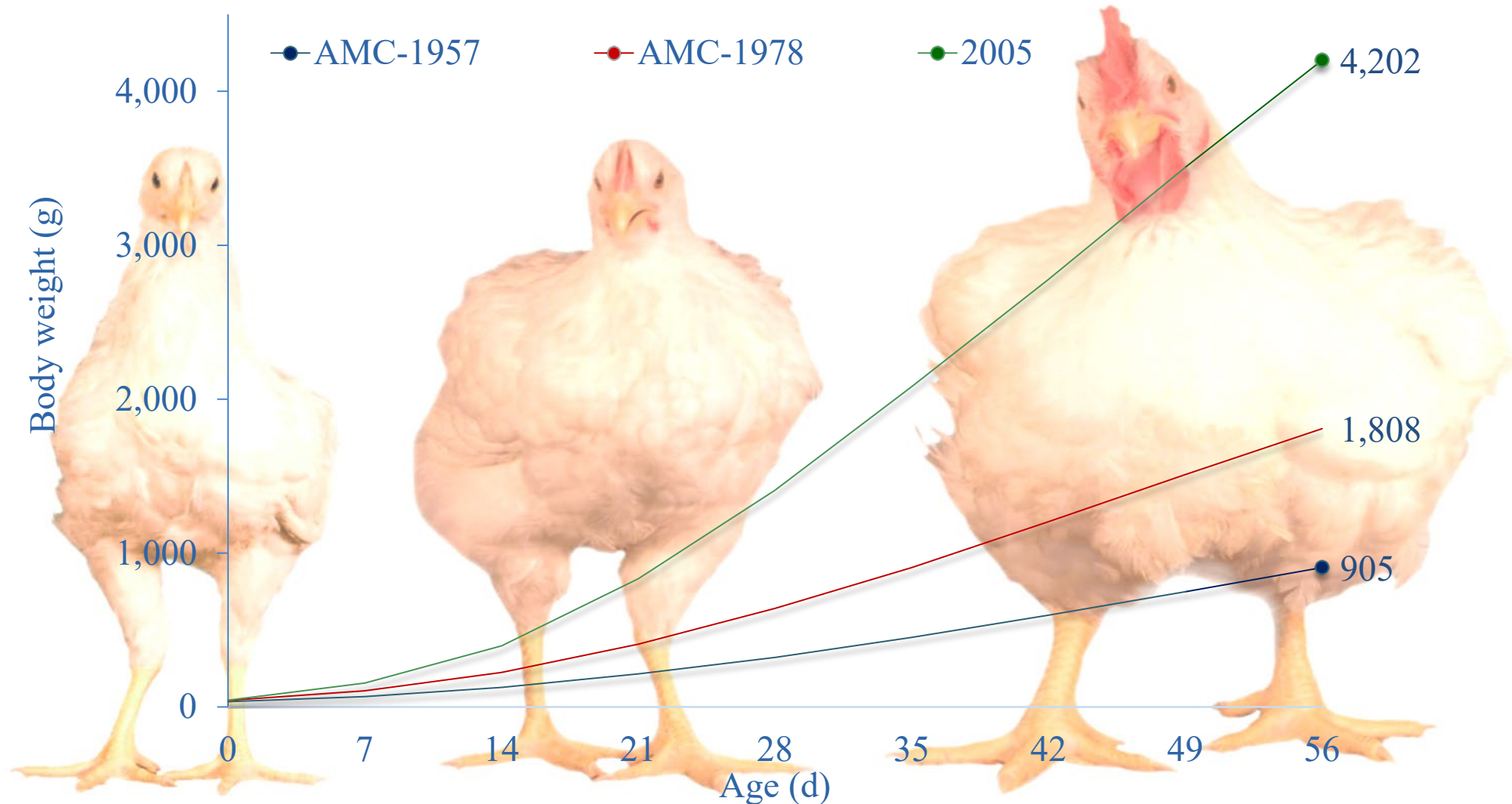
Highlights from “50 year study”

To assess the impact of 5 decades of quantitative genetic selection on broiler

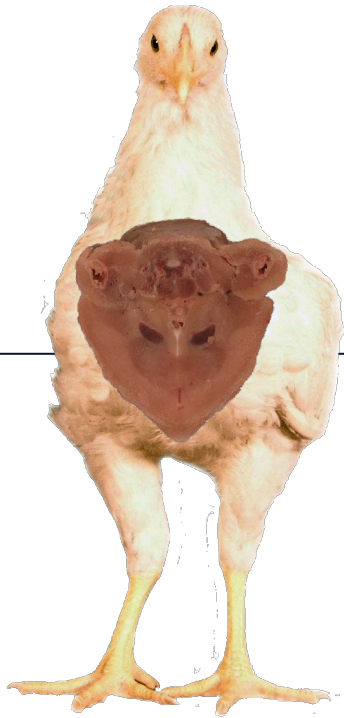
- ▶ Growth
- ▶ Efficiency
- ▶ Yield



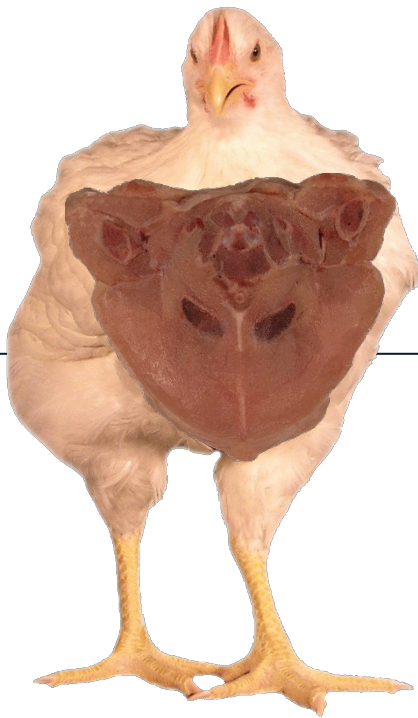
Body Weight



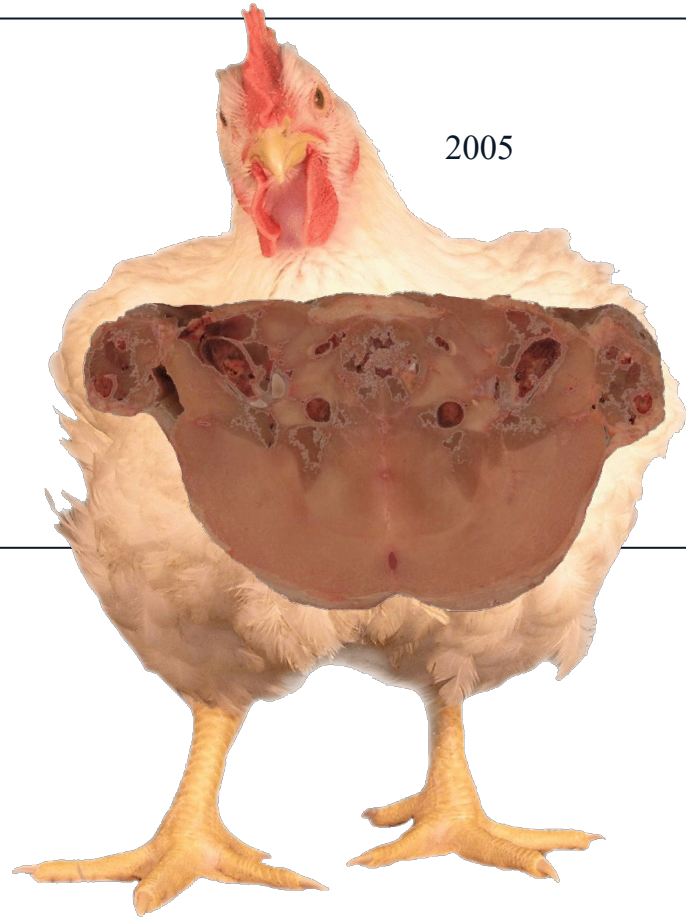
AMC-1957



AMC-1977



2005



Breast Yield (% live weight)

Yield 10.7^c ± 0.1

11.2^b ± 0.01

17.9^a ± 0.01

BCR
(g:g) 28.2^c ± 0.1

17.0^b ± 0.01

9.4^a ± 0.01



AMC-1957

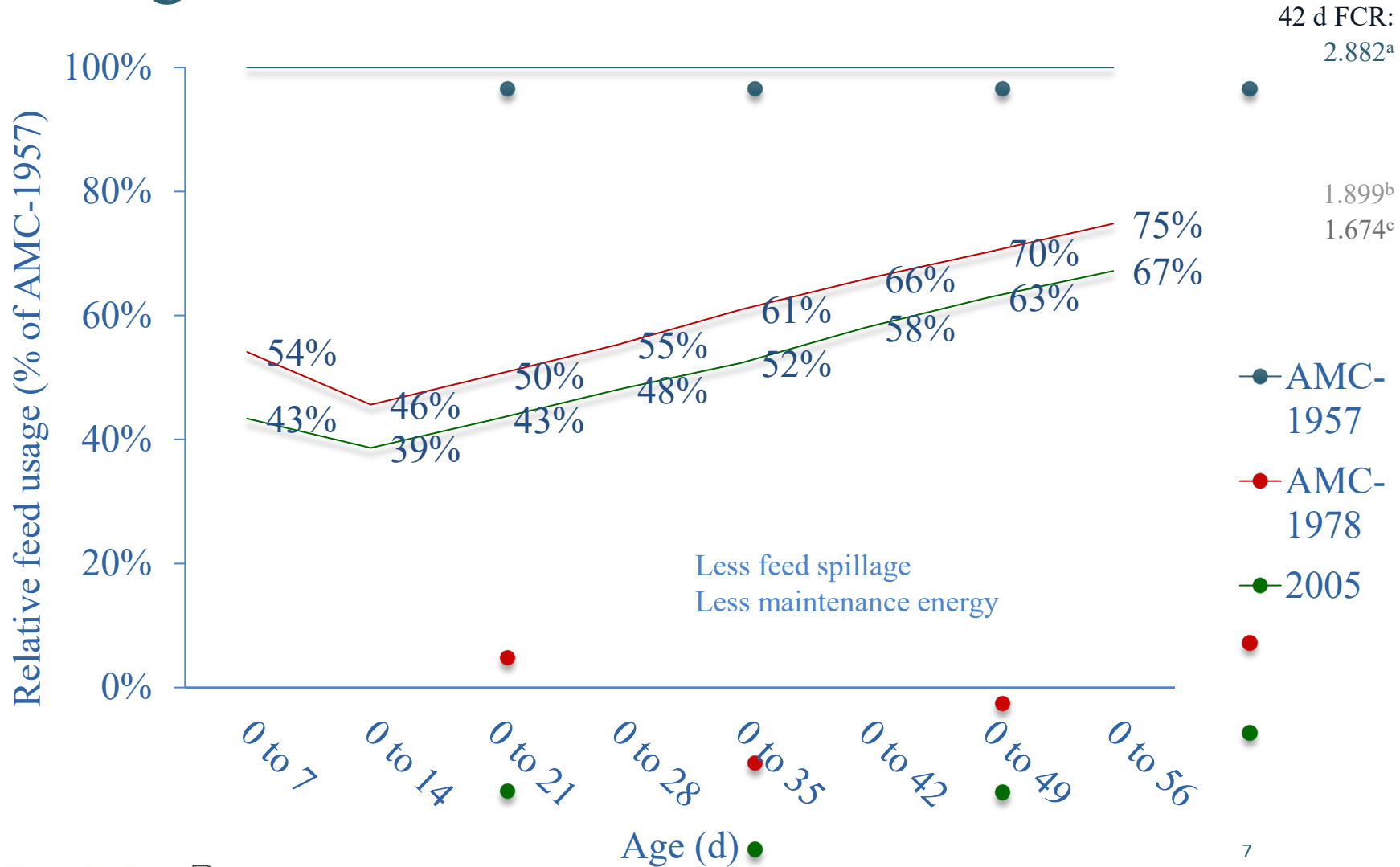


AMC-1977

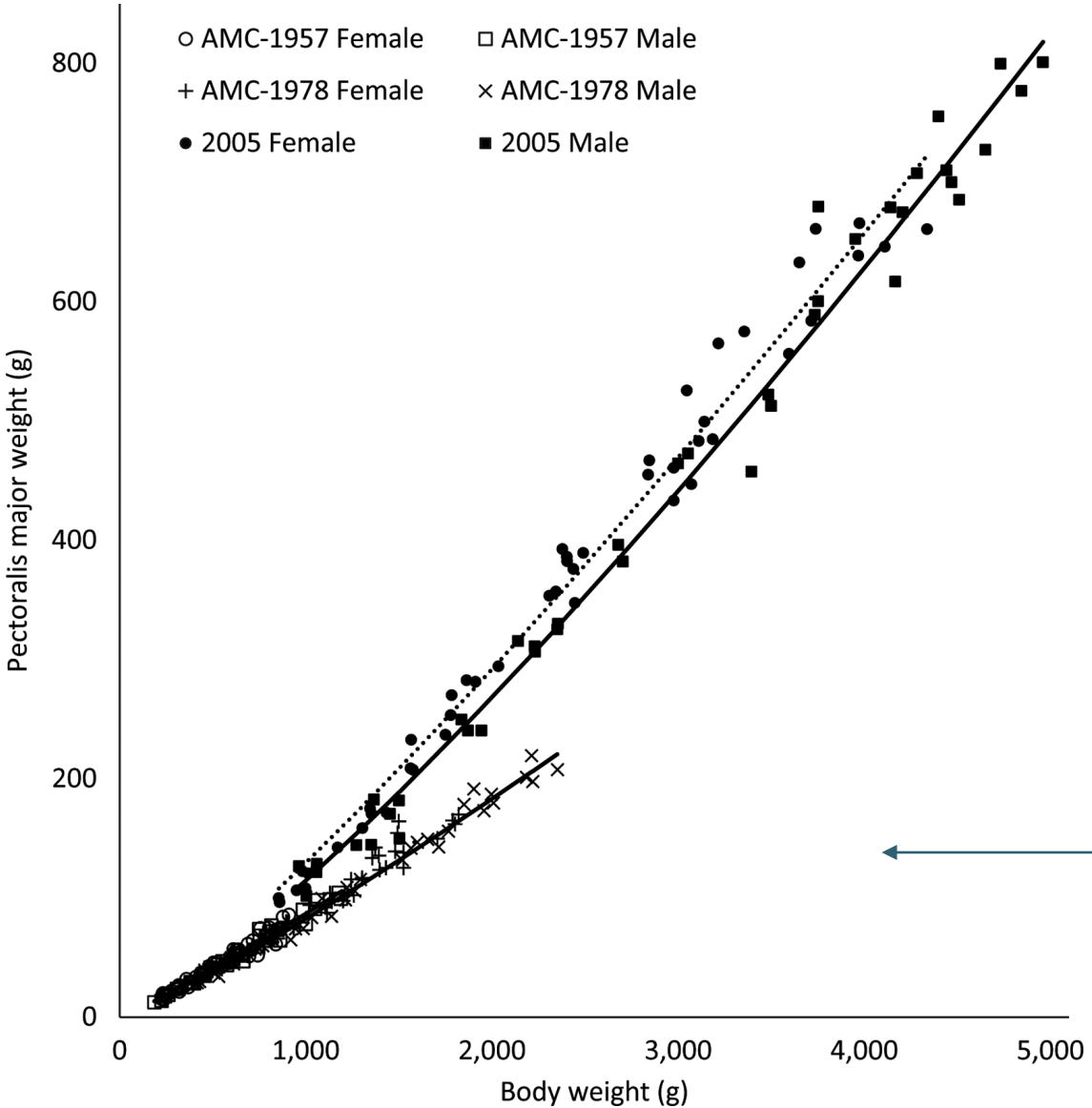


2005

Feed Usage



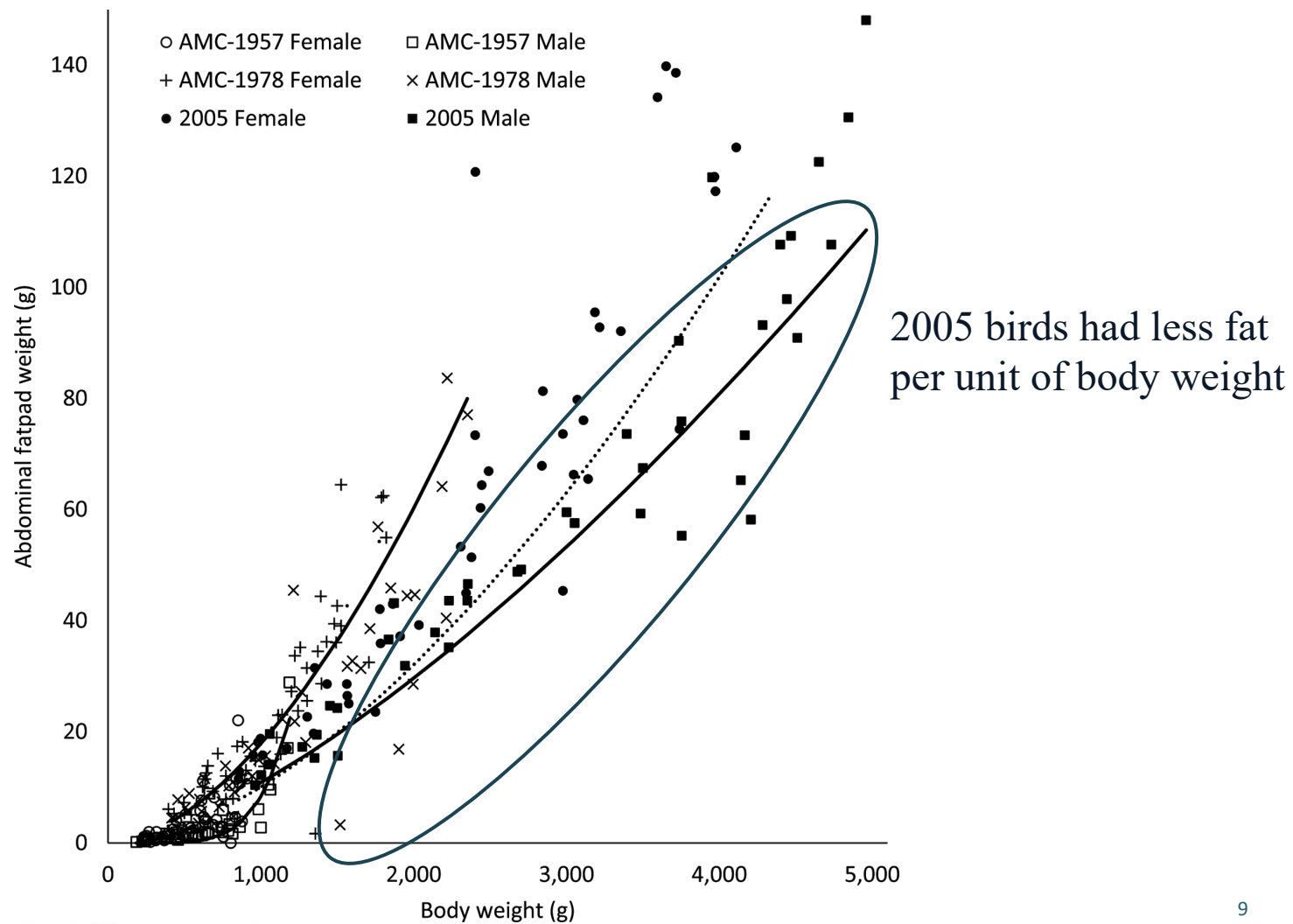
Breast Yield Allometry



2005 birds breast yield was shifted upward

← 1957 and 1978 birds had similar breast yield pattern

Abdominal Fatpad Allometry



50 years of selection for Broiler traits

- ▶ Quadrupling of 56 d Bodyweight
- ▶ Proportion of Breast yield increase and conformation changed
- ▶ Fatpad proportion relative to body decreased over 50 years

...Consequences for Broiler Breeders

“60 year trial”

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60-year trial

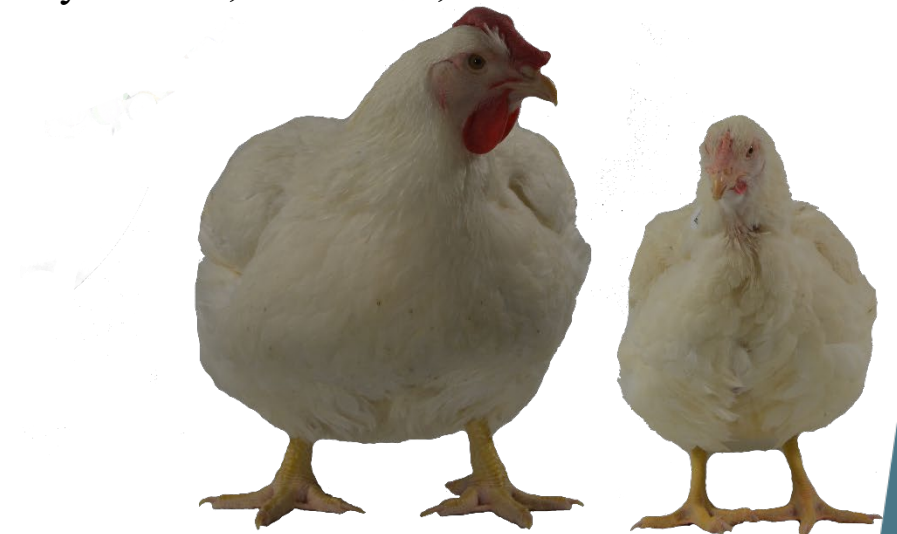
PROGRESSION OF FEED RESTRICTION

Evolution of maternal feed restriction practices over 60 years of selection for broiler productivity

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**Ovary of a feed
restricted hen**



**Ovary of a
full-fed hen**

Design



AMC 1957

AMC 1978 – male line

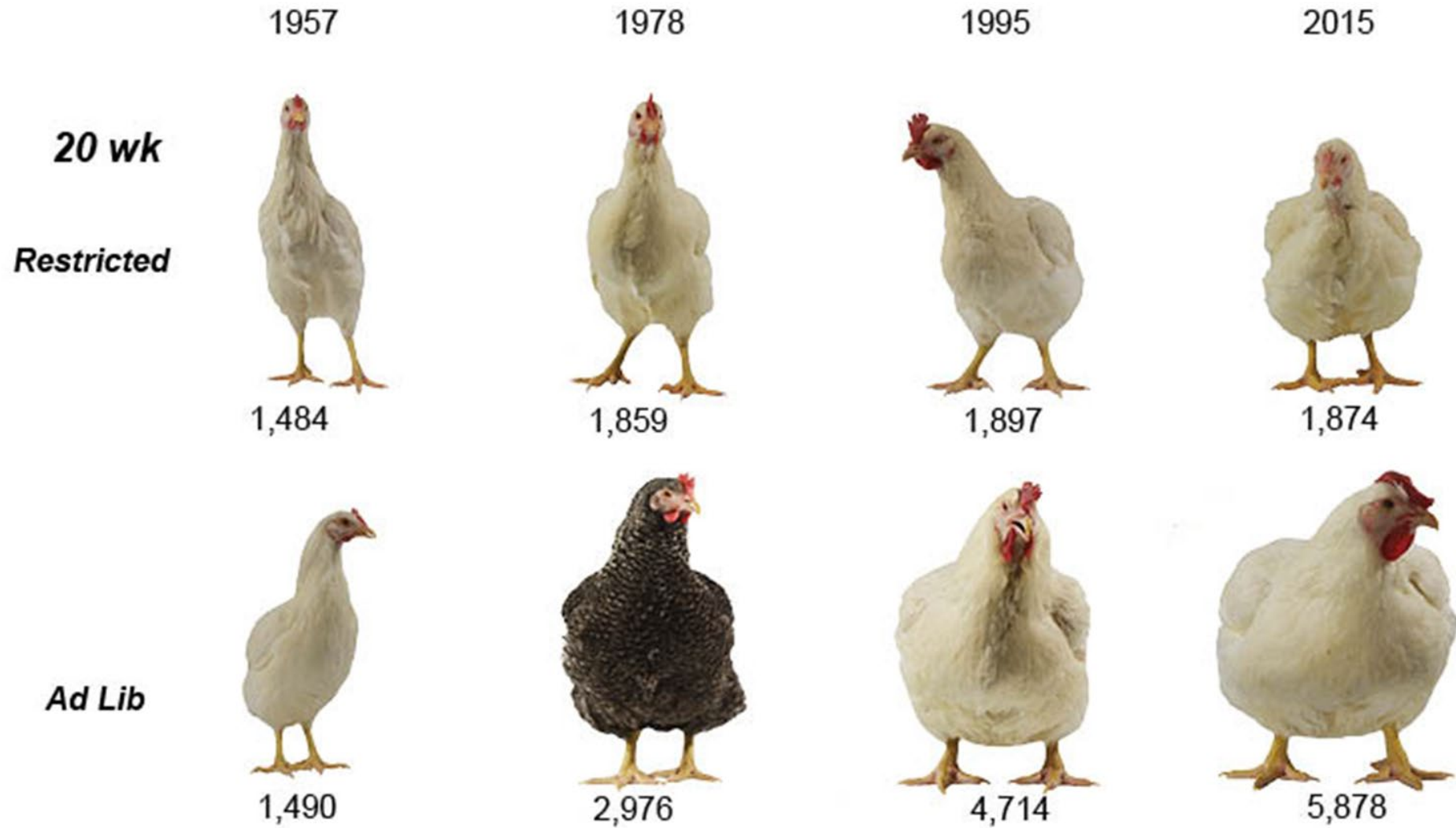


Random bred 1995

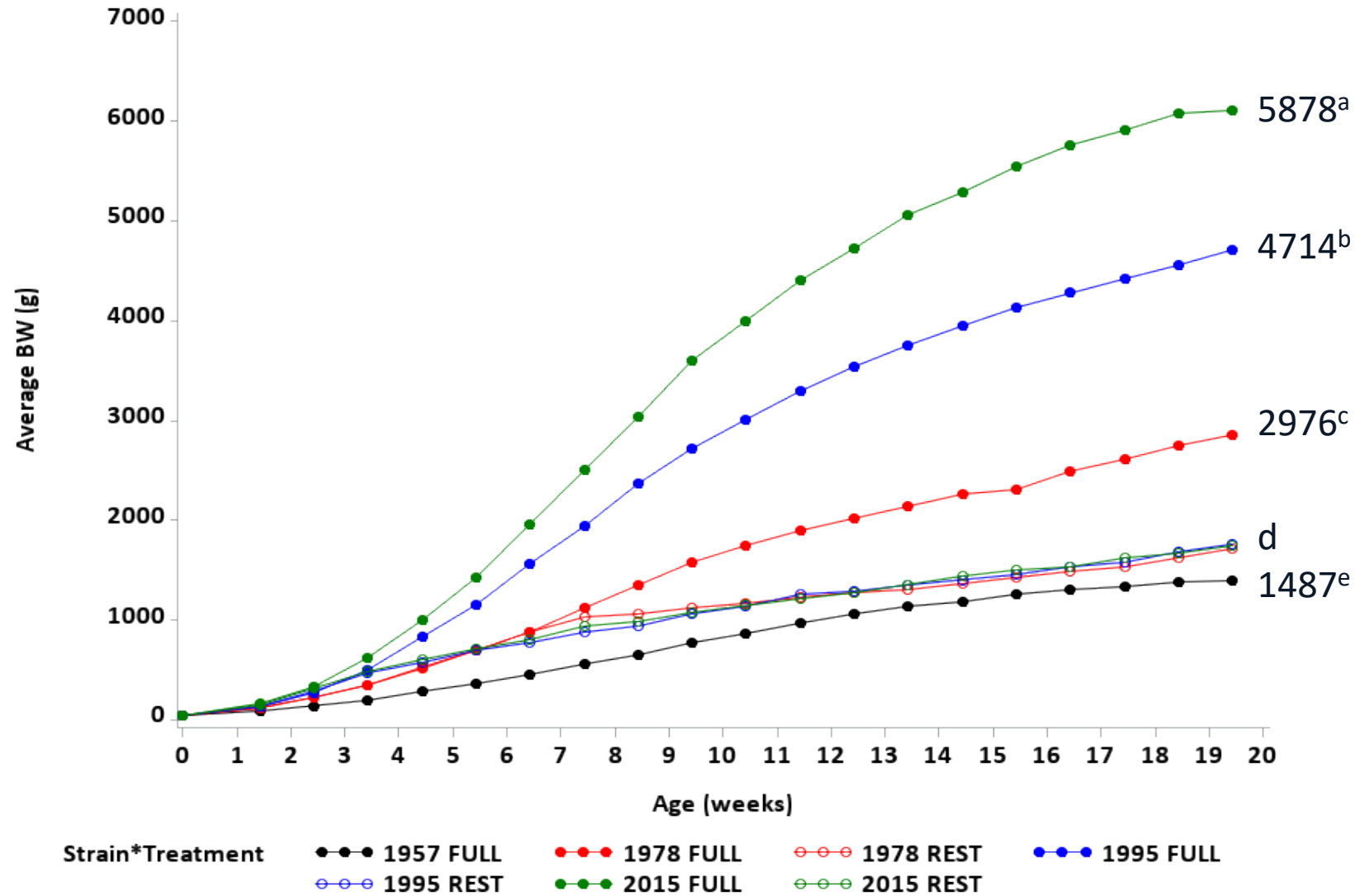
Random bred 2015

- 2 X 4 Factorial
 - Feeding Treatments
 - Full Fed – *ad libitum*
 - Restricted to 2015 curve
 - (average of Cobb and Ross breeder targets)

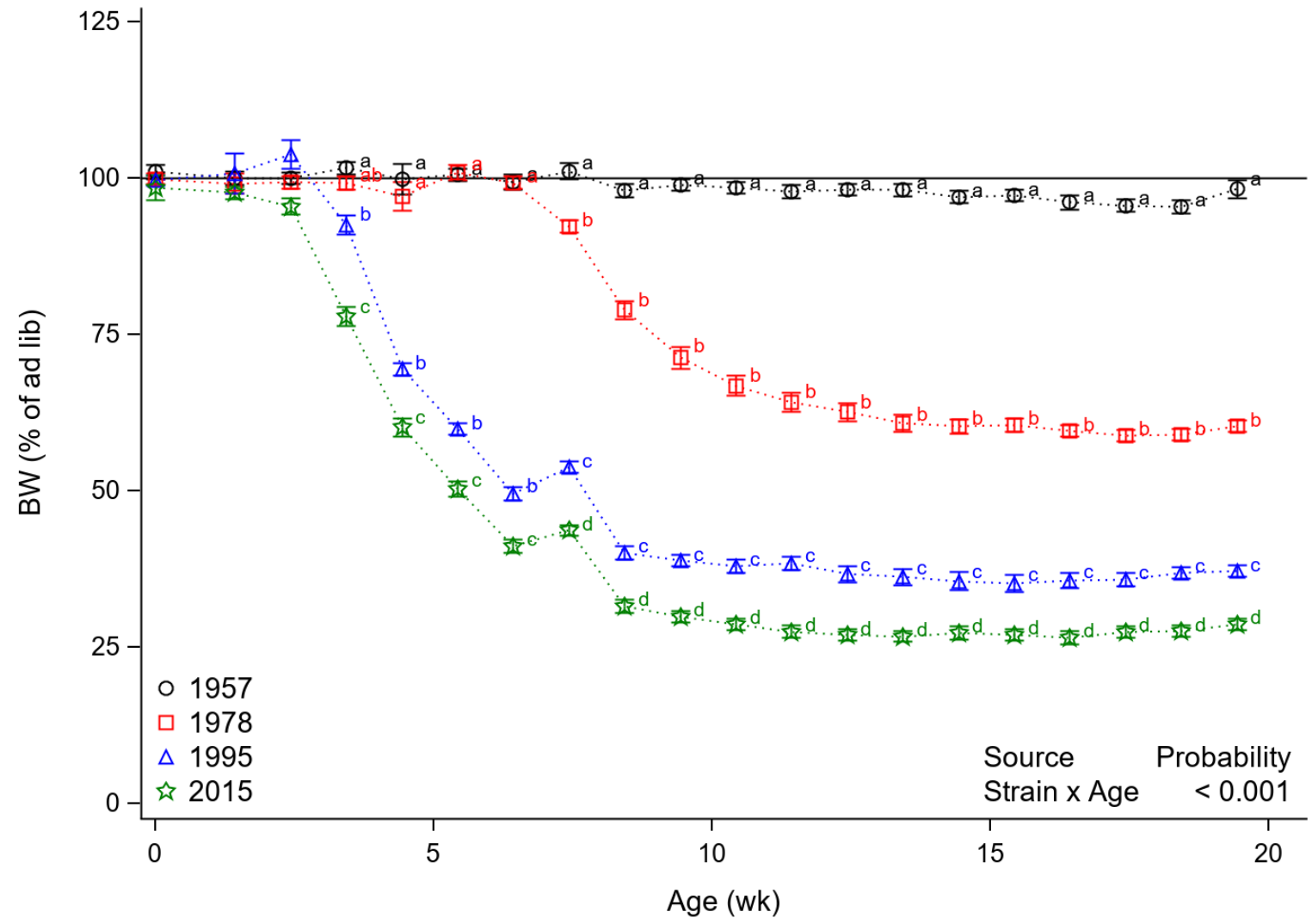




BW strain difference

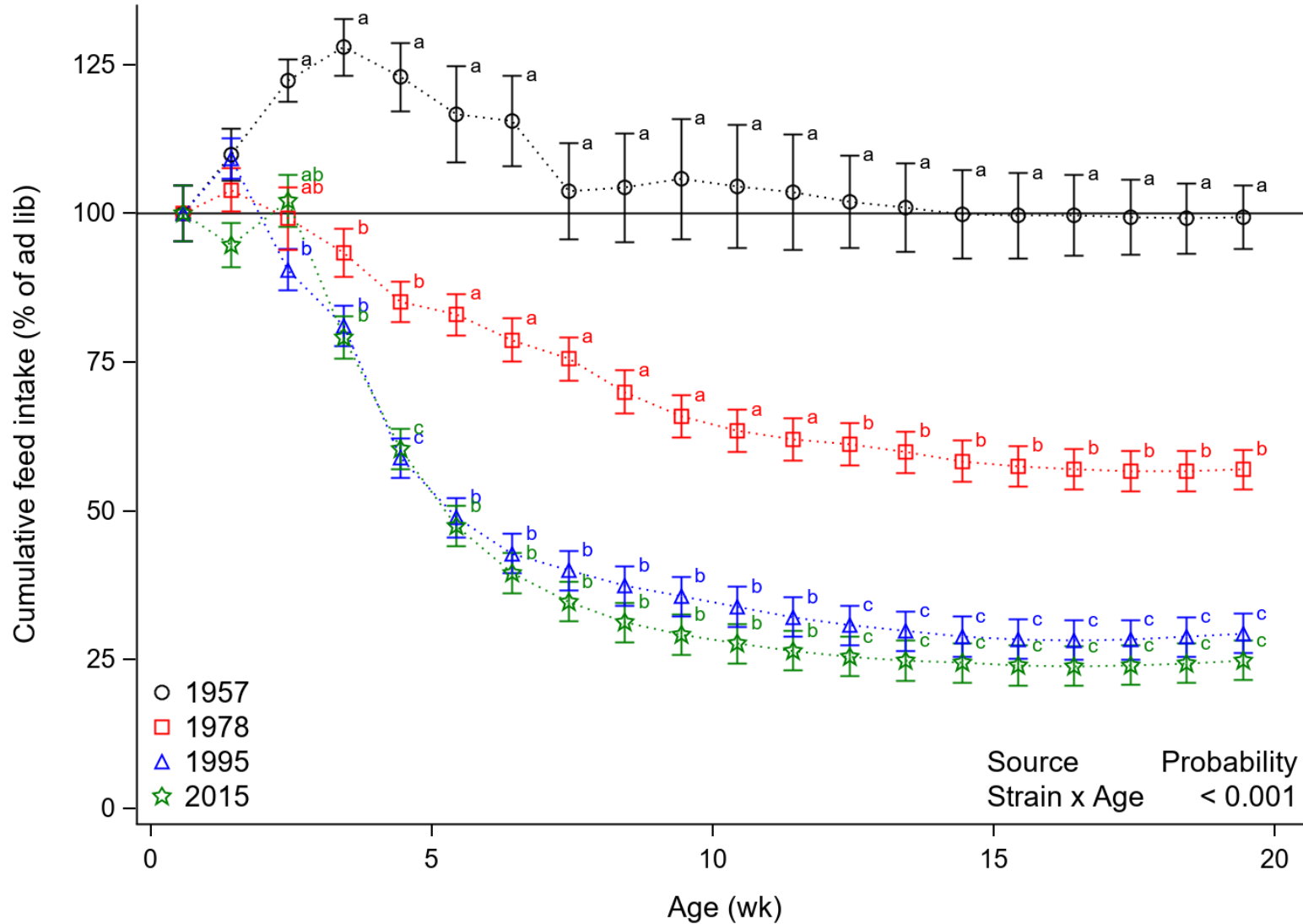


Restricted Body weight relative to ad libitum-fed

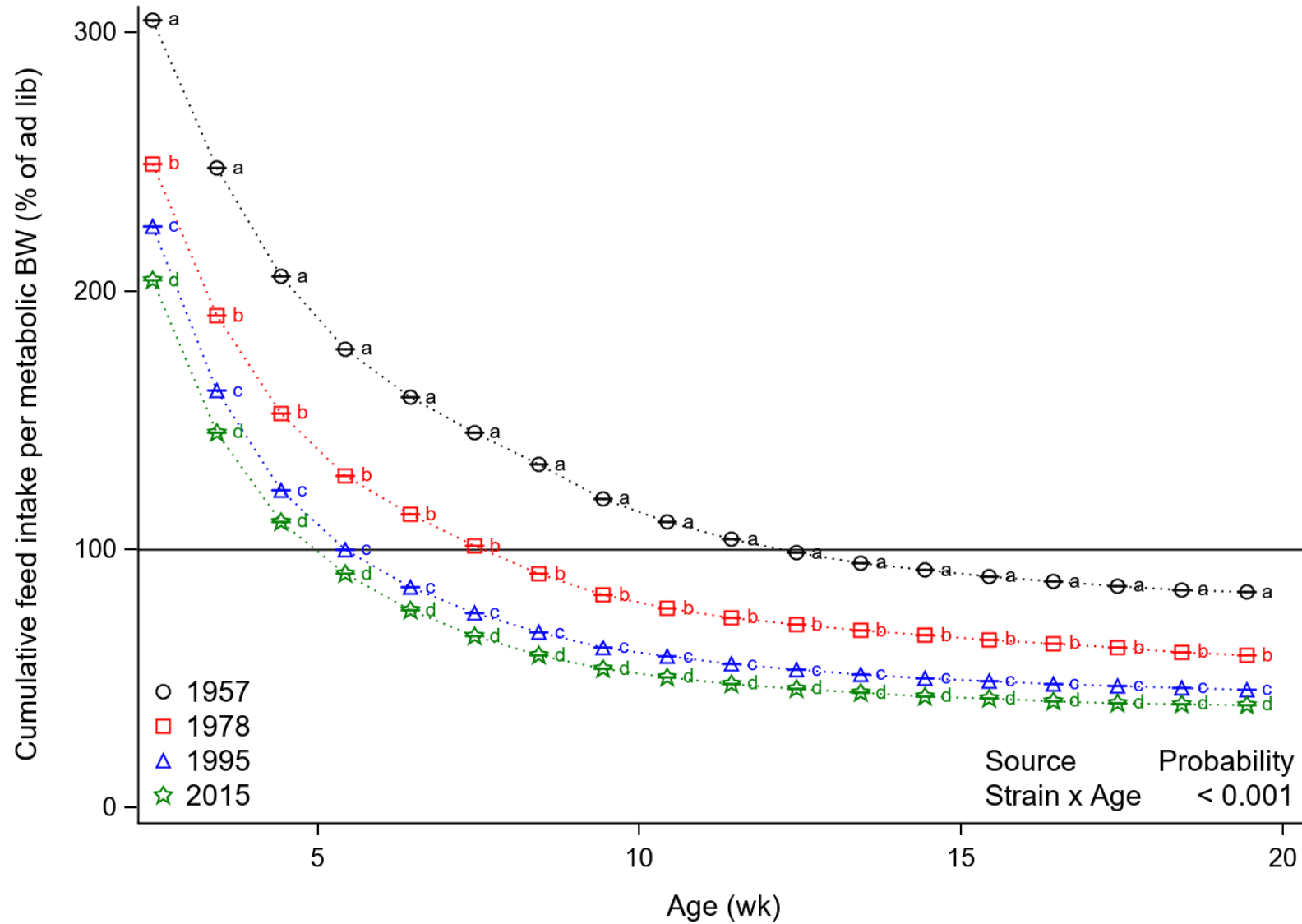


Source Probability
Strain x Age < 0.001

Cumulative Feed Intake

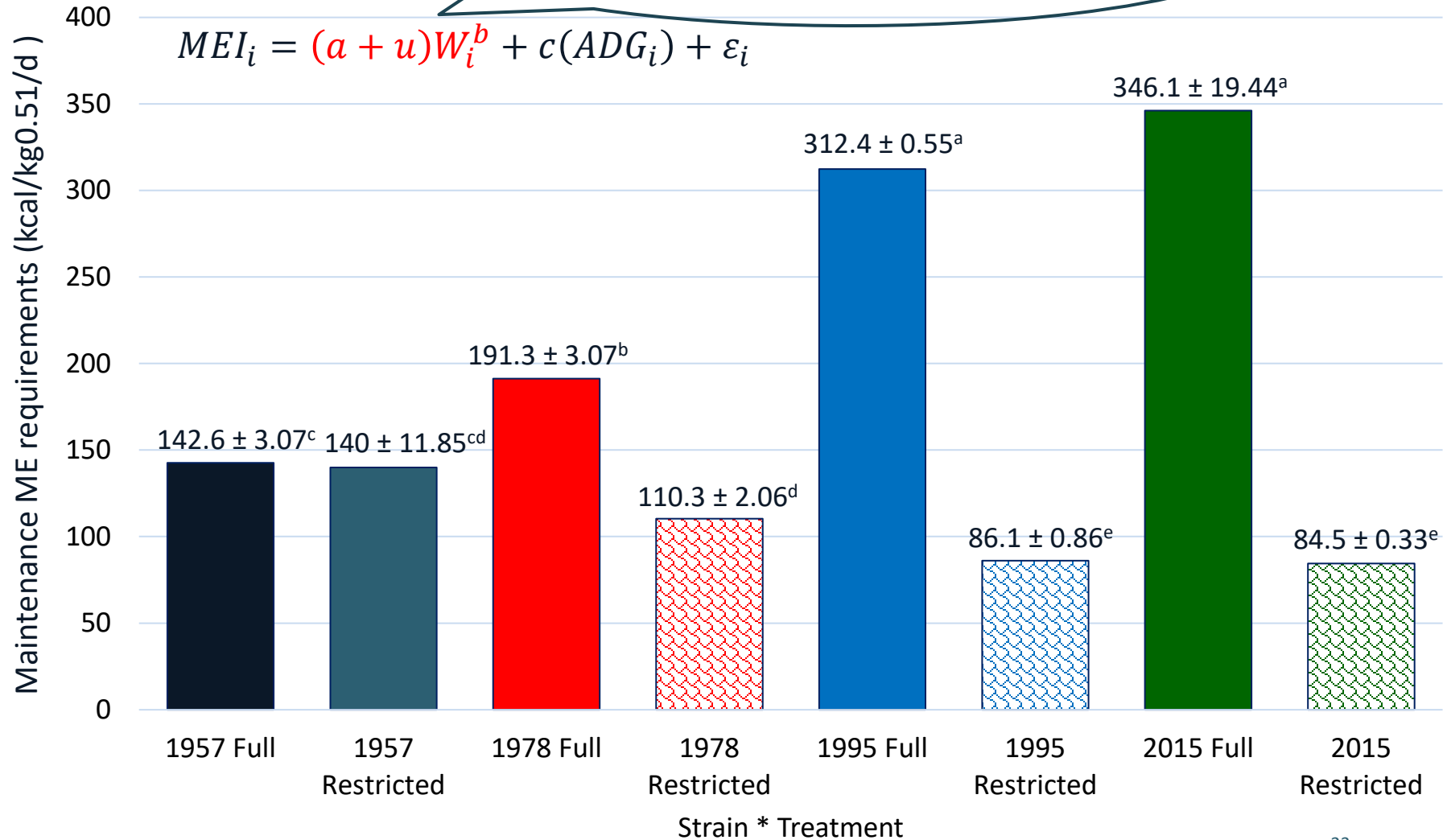


Cumulative Feed Intake per unit of metabolic BW ($BW^{0.51}$)

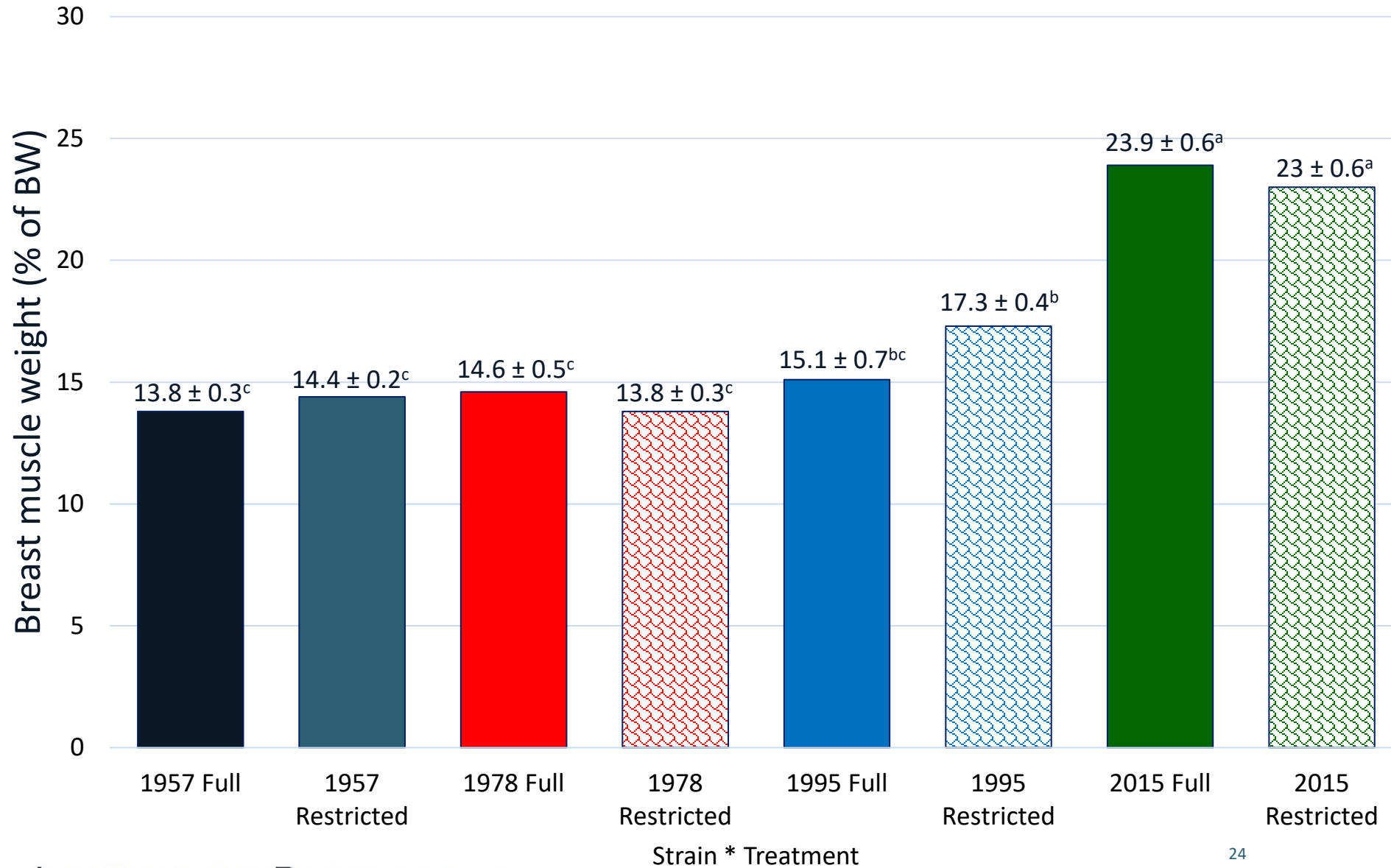


Energy efficiency

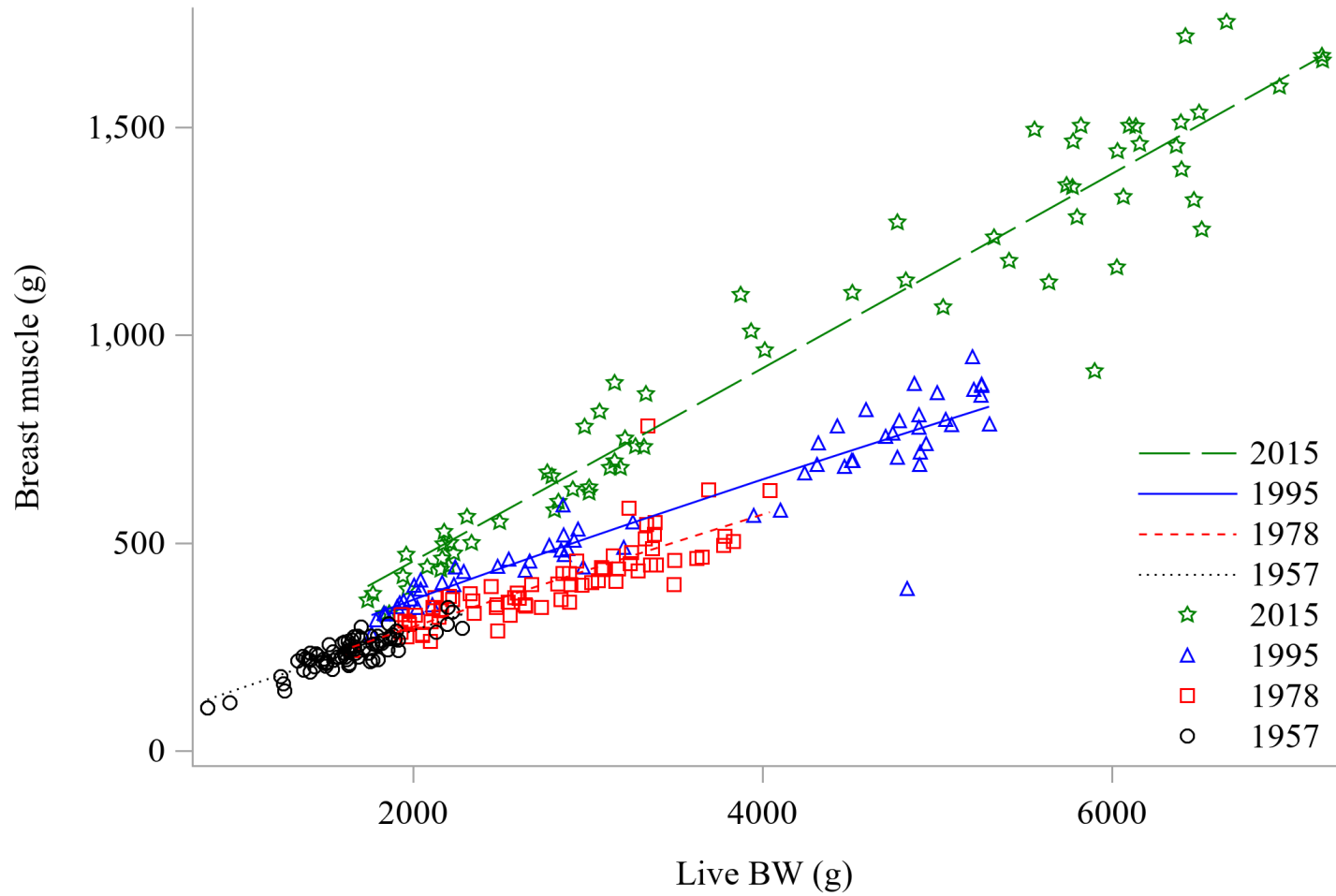
Estimated daily maintenance ME requirements (heat production)



Breast weight at Sexual Maturity



Breast weight nonlinear covariance analysis



$$y = ax^b$$

P value < 0.001

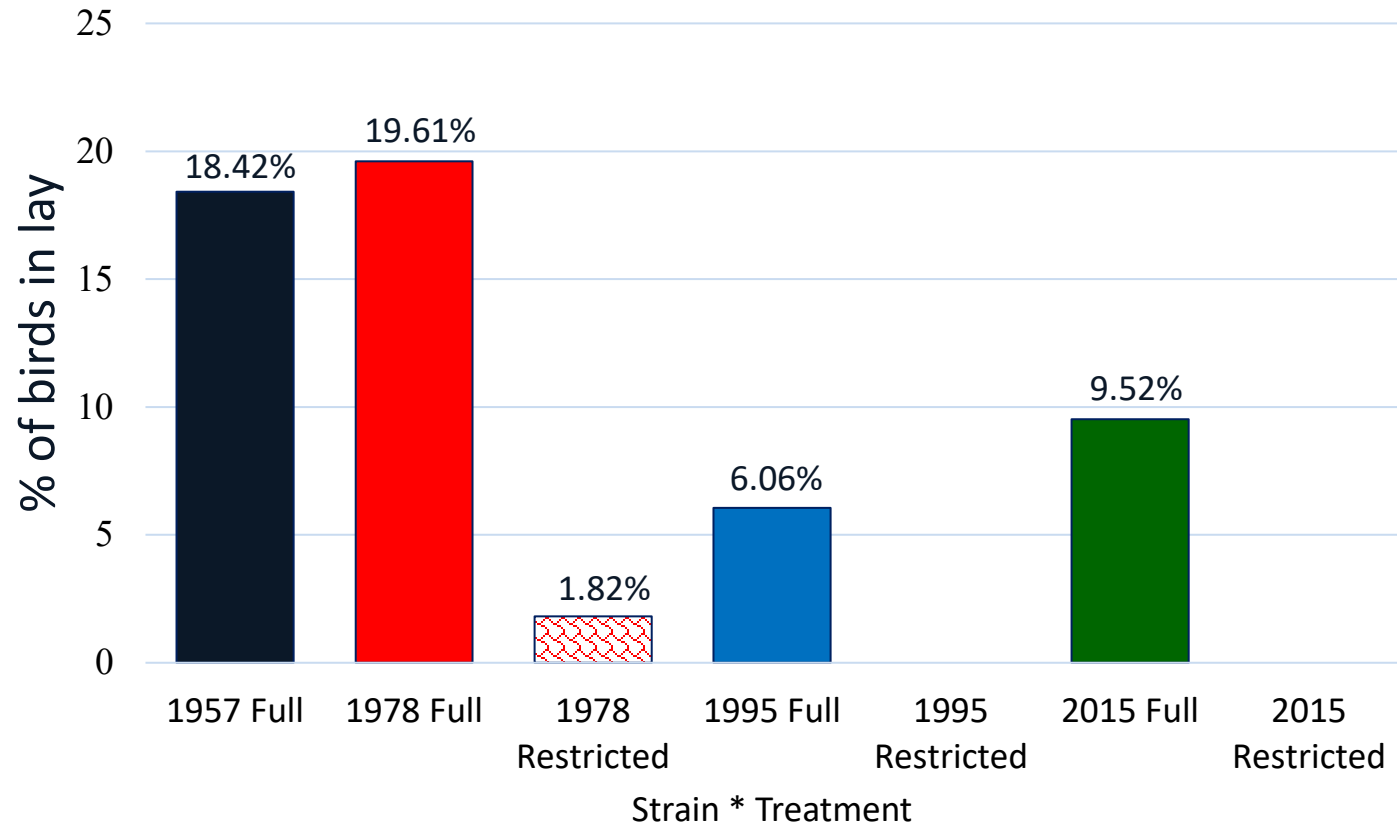
60 years of selection for Broiler traits... consequences for Breeders

- ▶ Quadrupling of bodyweight
- ▶ Relative feed intake decreased to 25% of ad libitum
- ▶ Reduced heat loss with feed restriction
- ▶ Breast proportion relative to body increased over 60 years

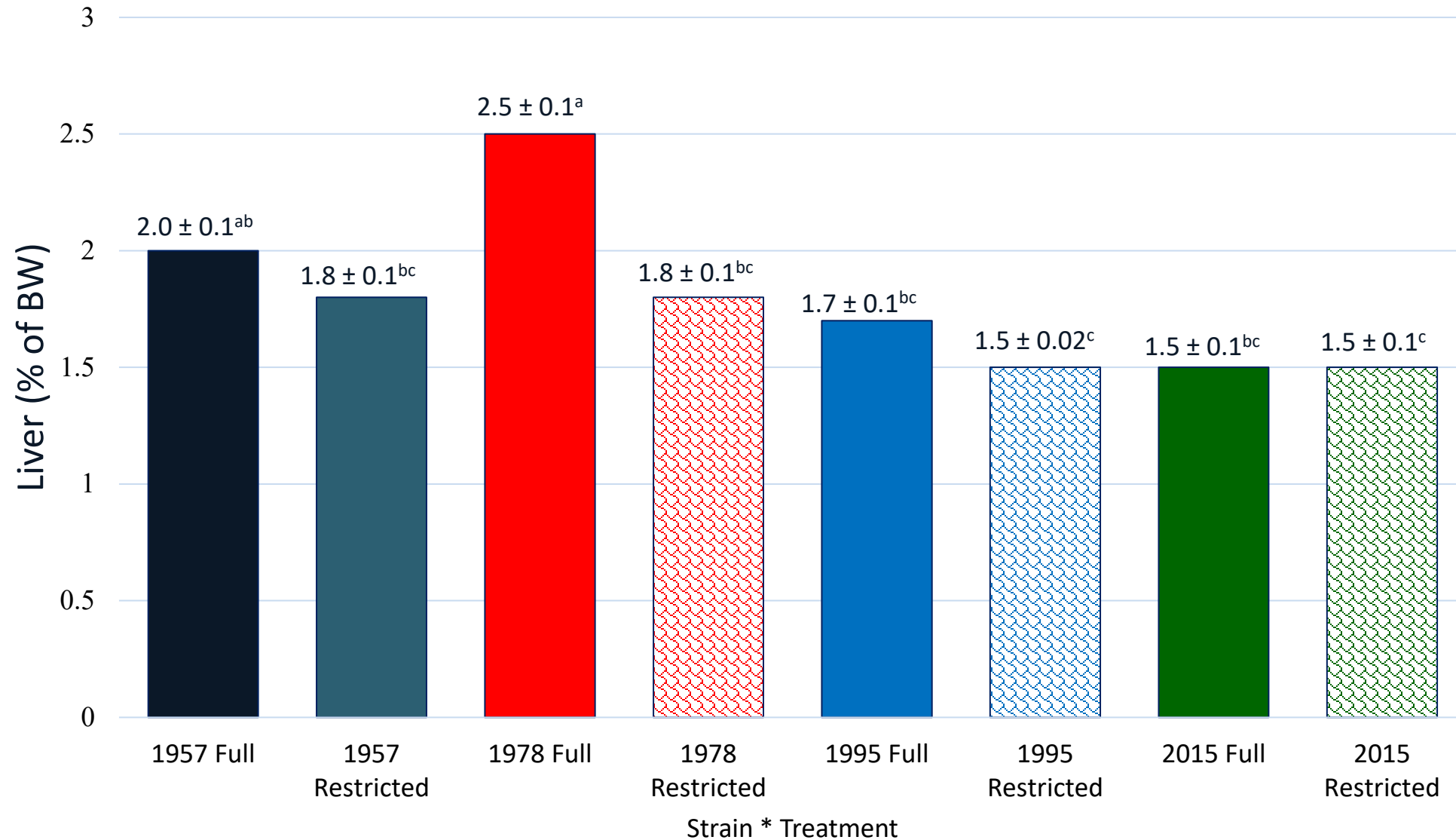


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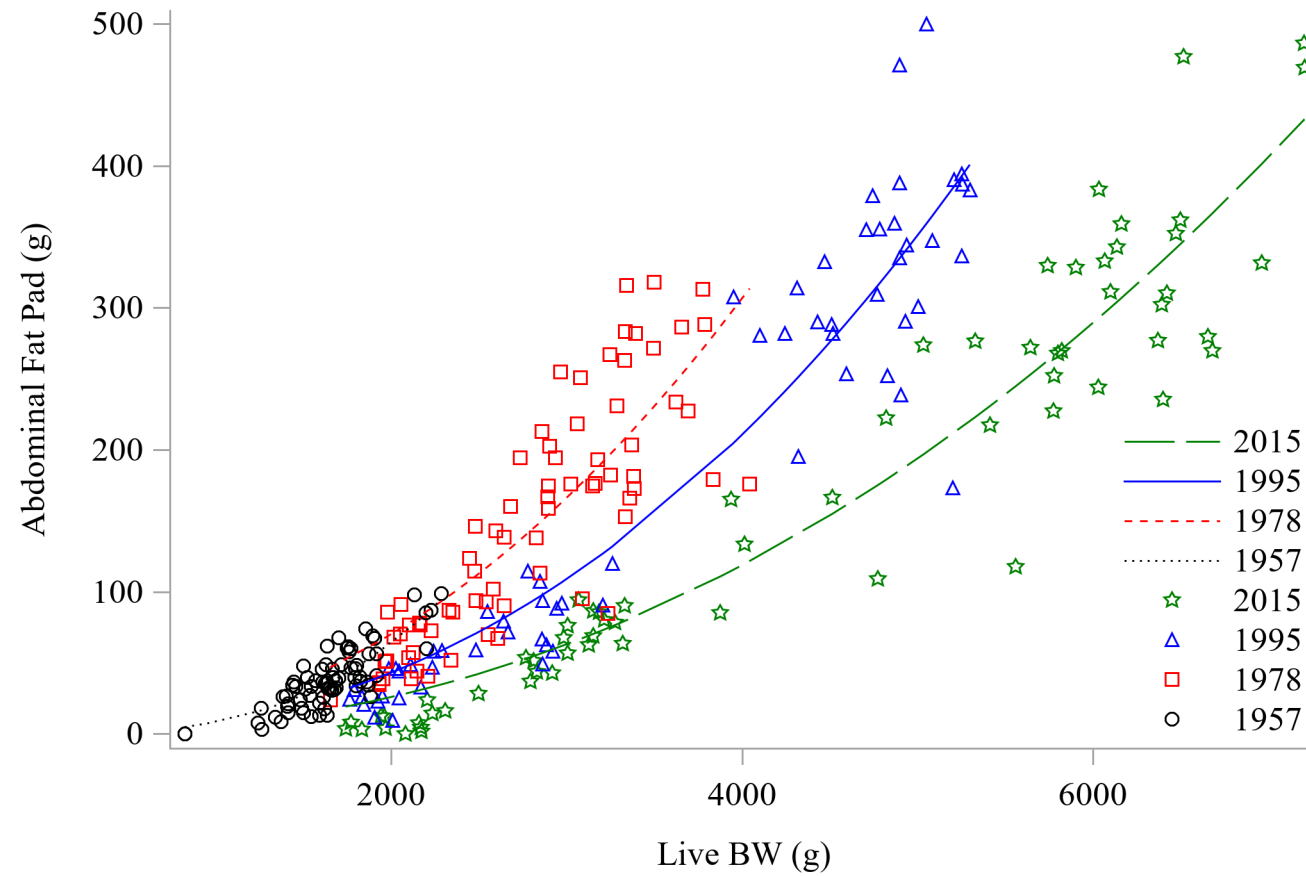
Percentage of birds in lay at PS



Liver at PS

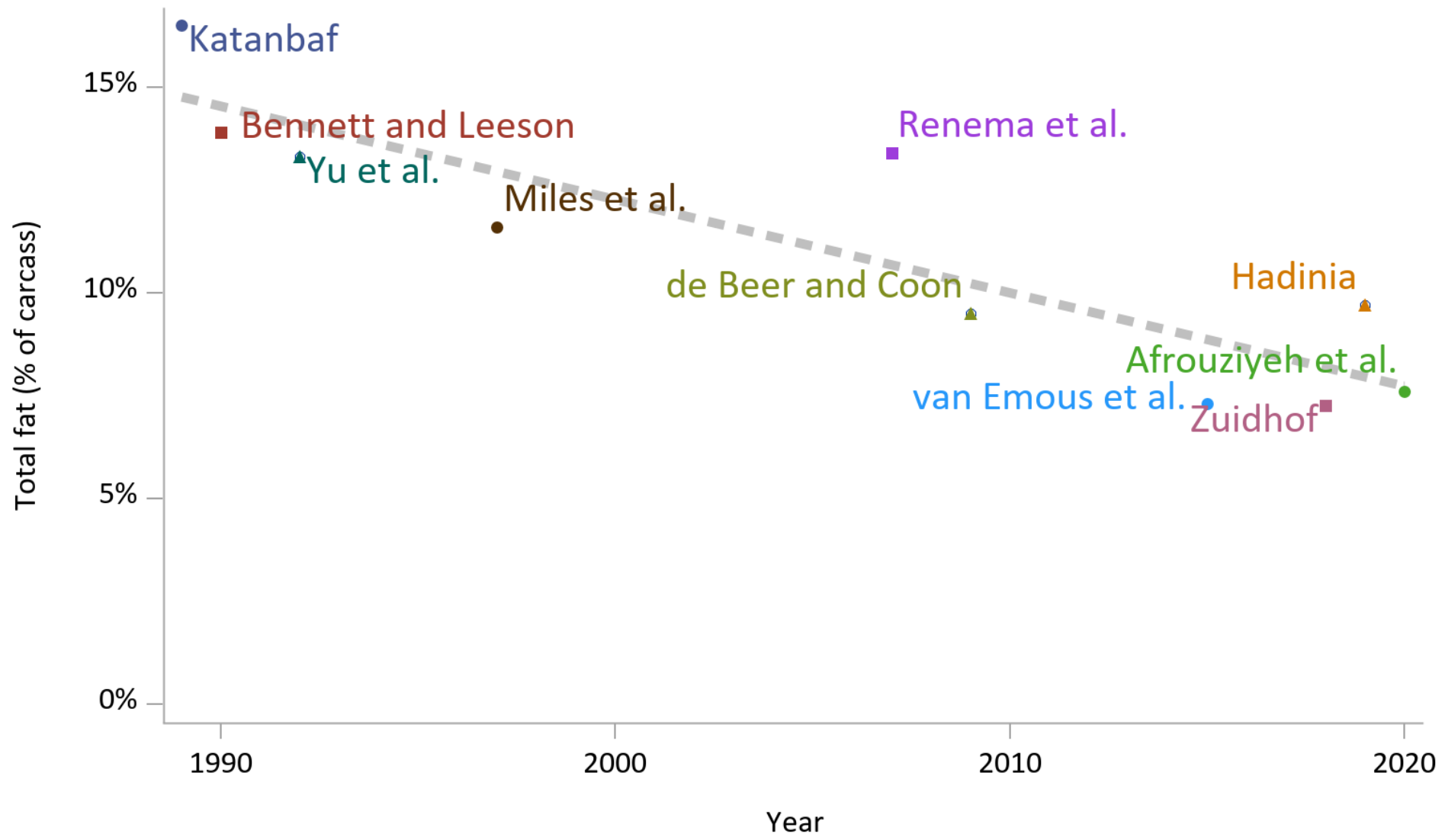


Abdominal fatpad nonlinear covariance analysis

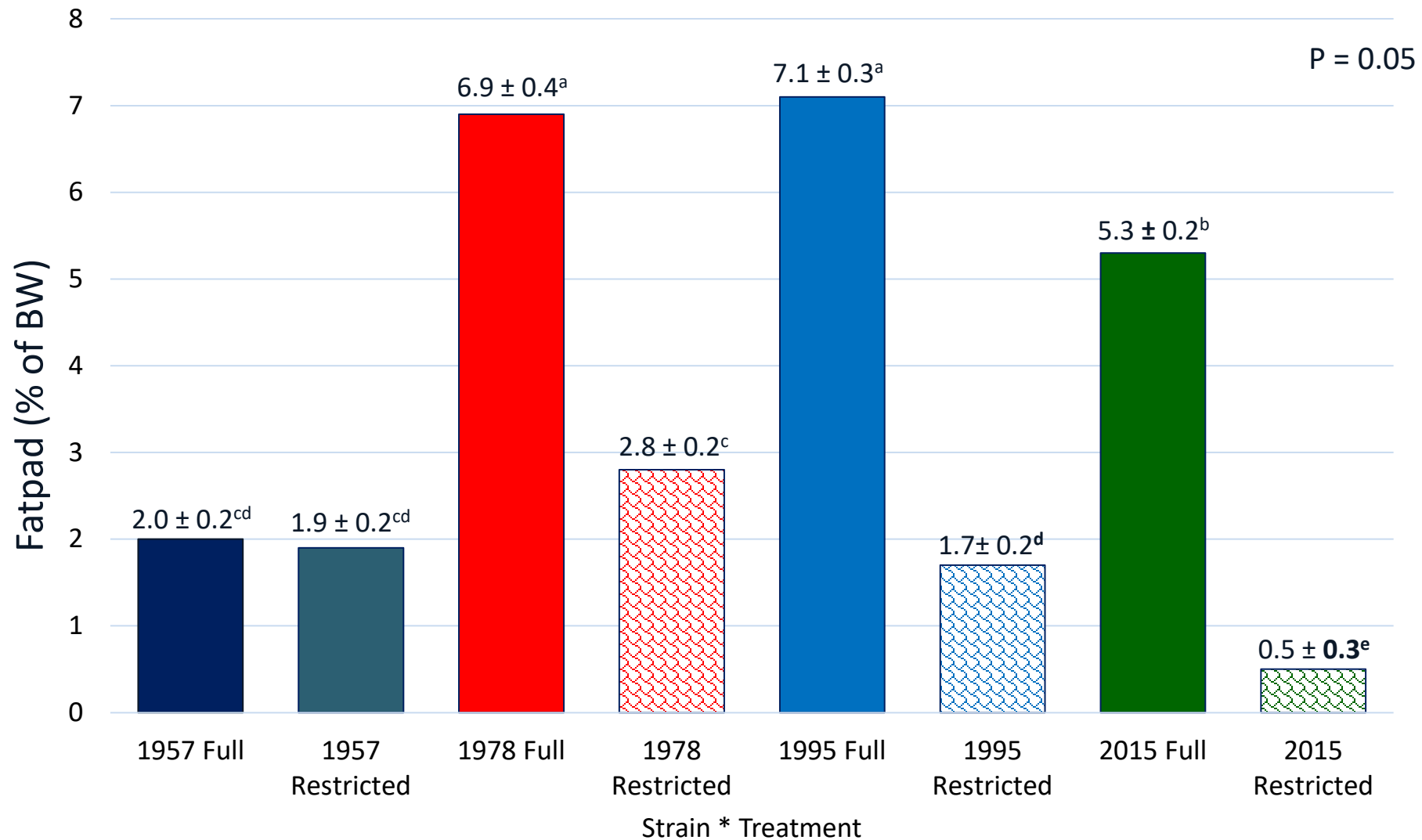


$$y = ax^b$$

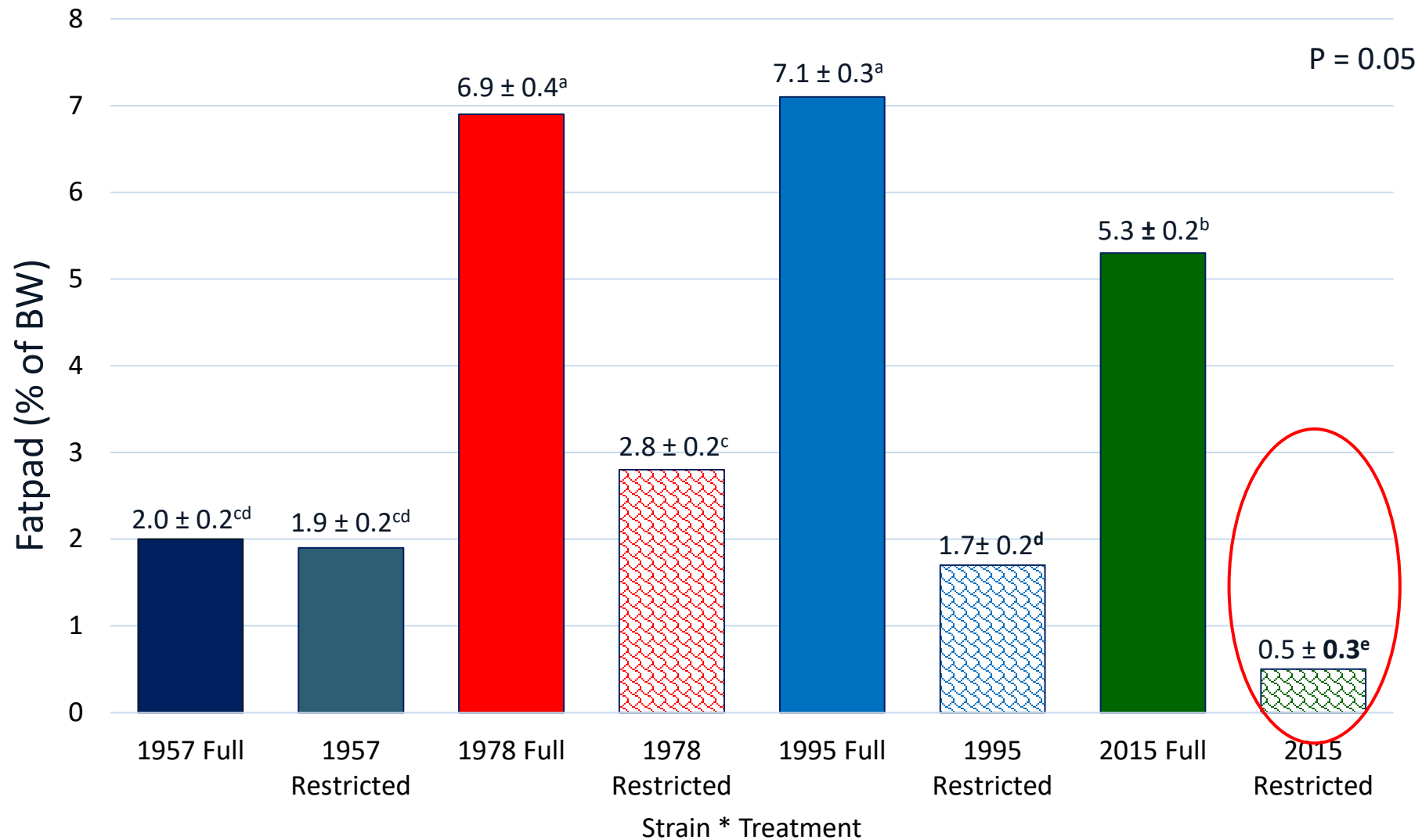
P value < 0.001



Abdominal fatpad at PS



Abdominal fatpad at PS



FCR Selection



20+ years ago

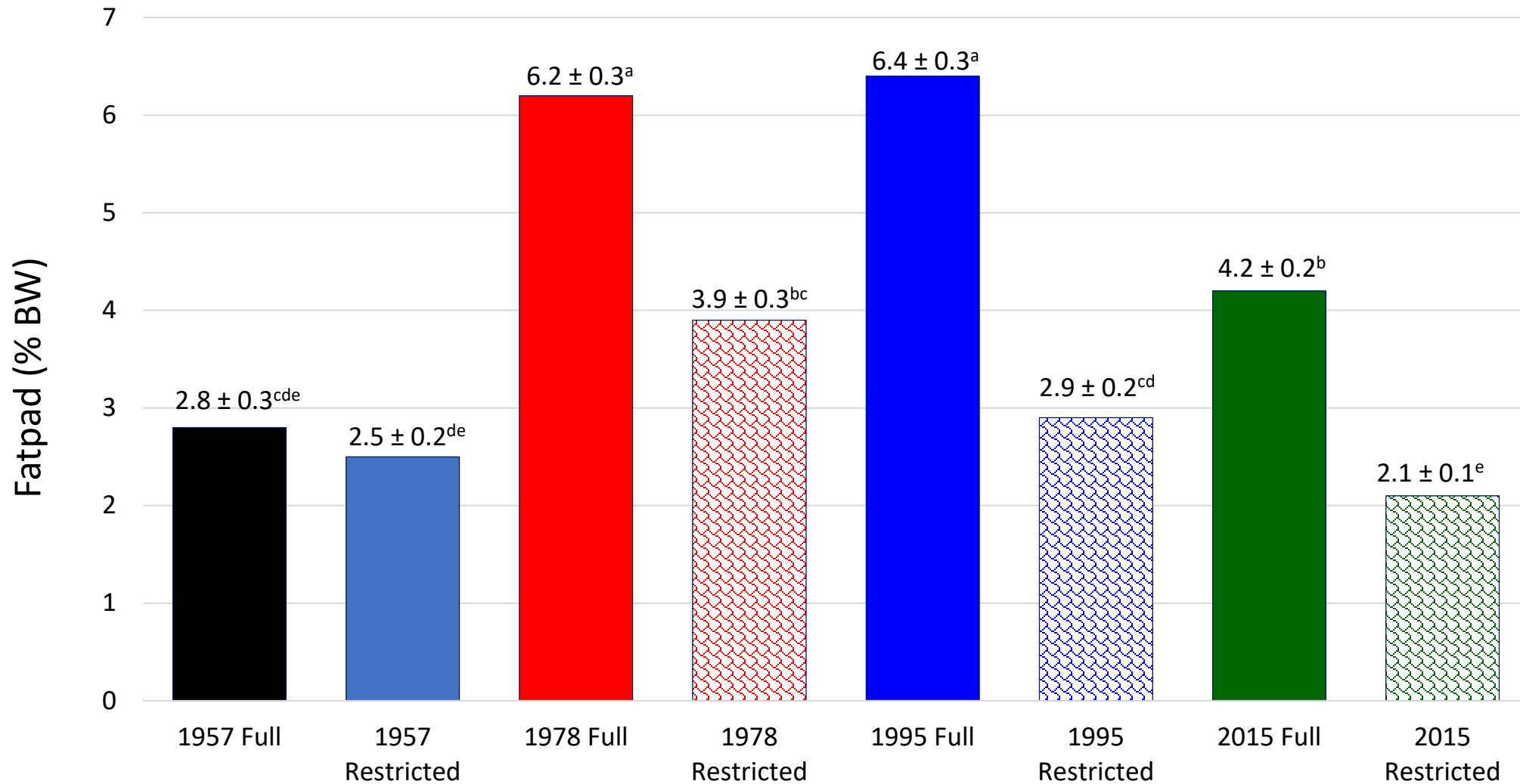


Current +

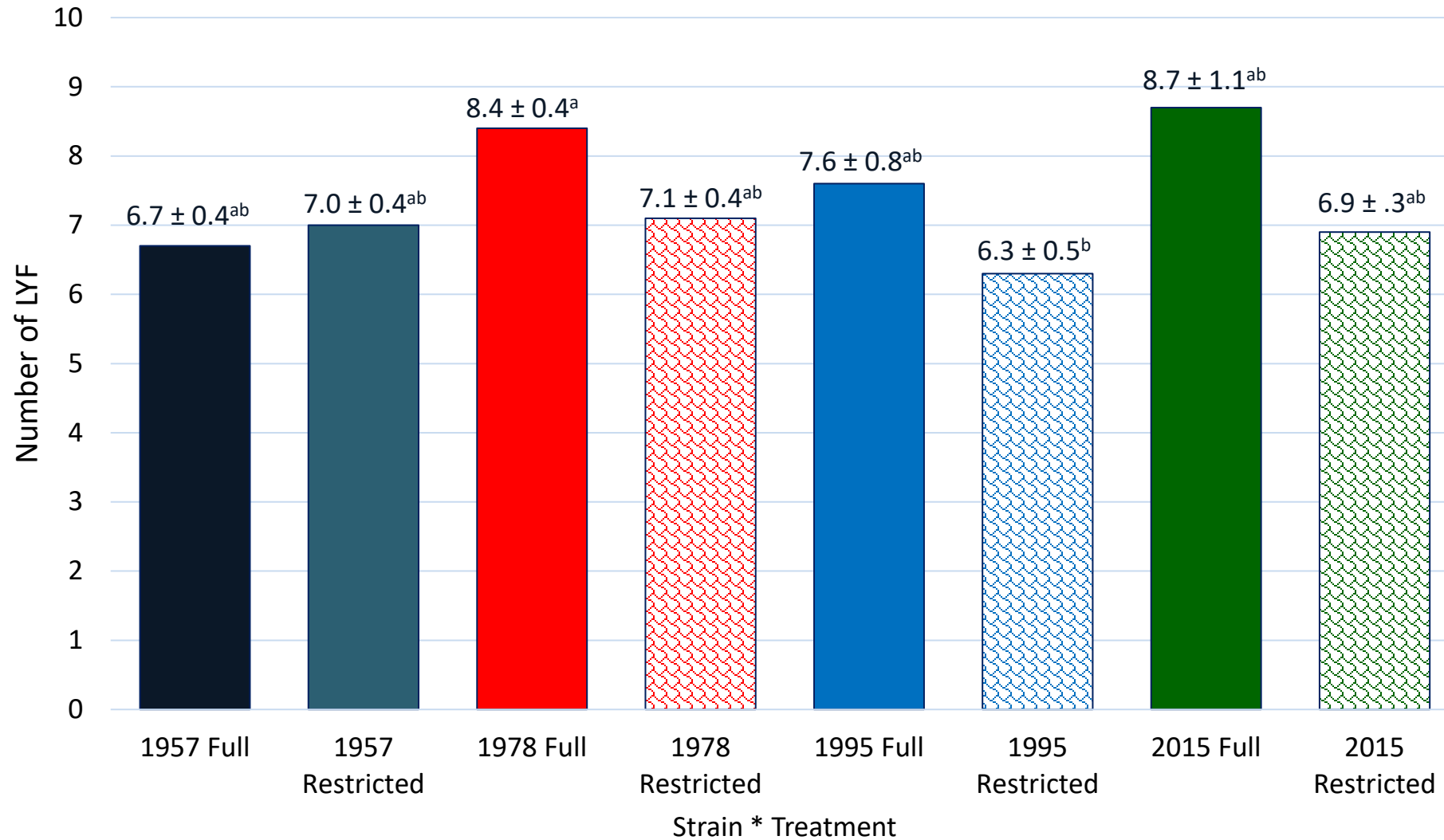
60 years of selection for Broiler traits... consequences for Breeders

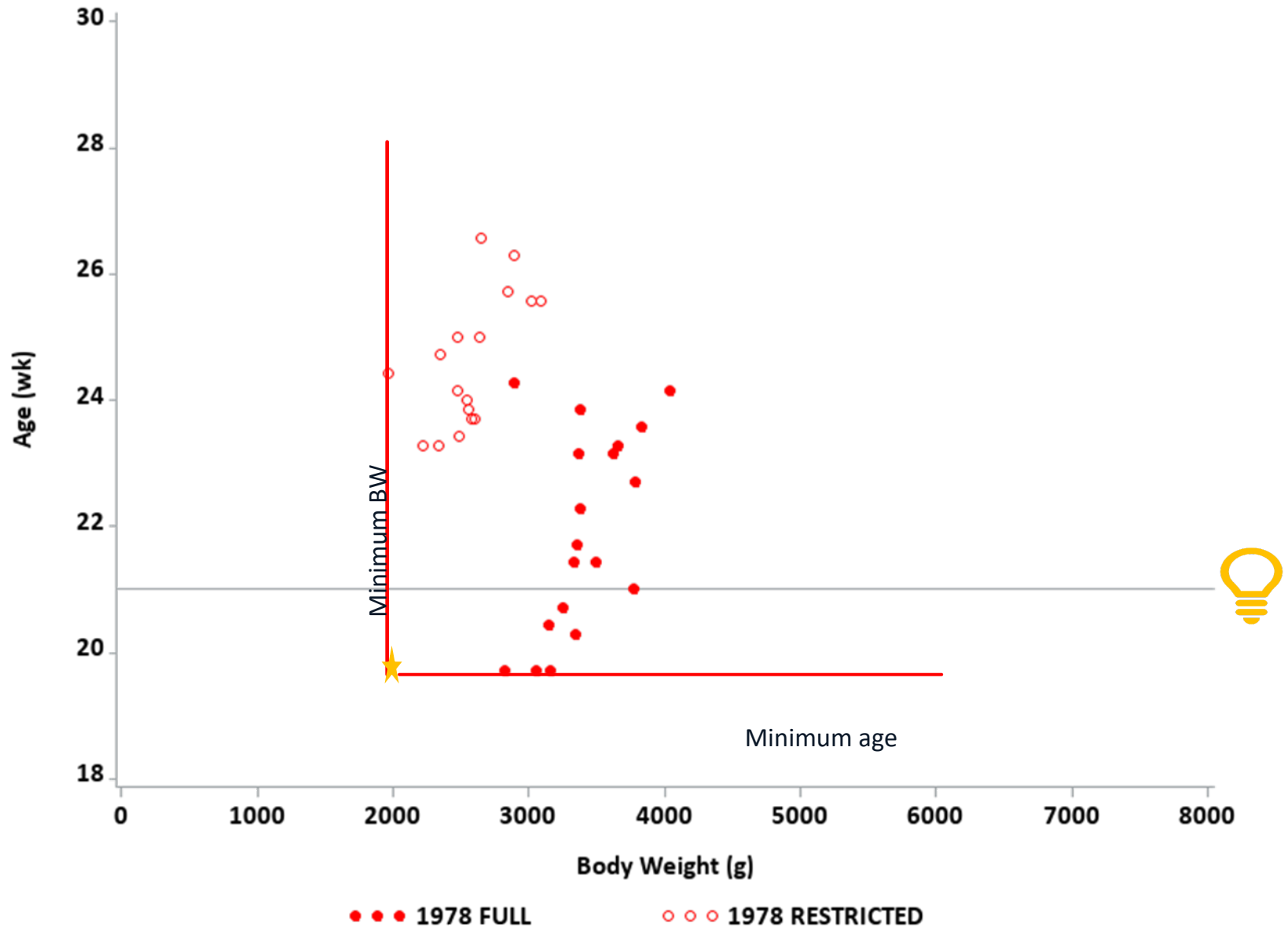
- ▶ Fatpad proportion relative to body decreased over 60 years
- ▶ Occurrence of puberty prior to PS not evident in 1995 and 2015 lines
- ▶ Liver size not affected by feeding treatment in 1995 and 2015 lines prior to PS
- ▶ Abdominal fatpad of 2015 at PS lower than that of 1957

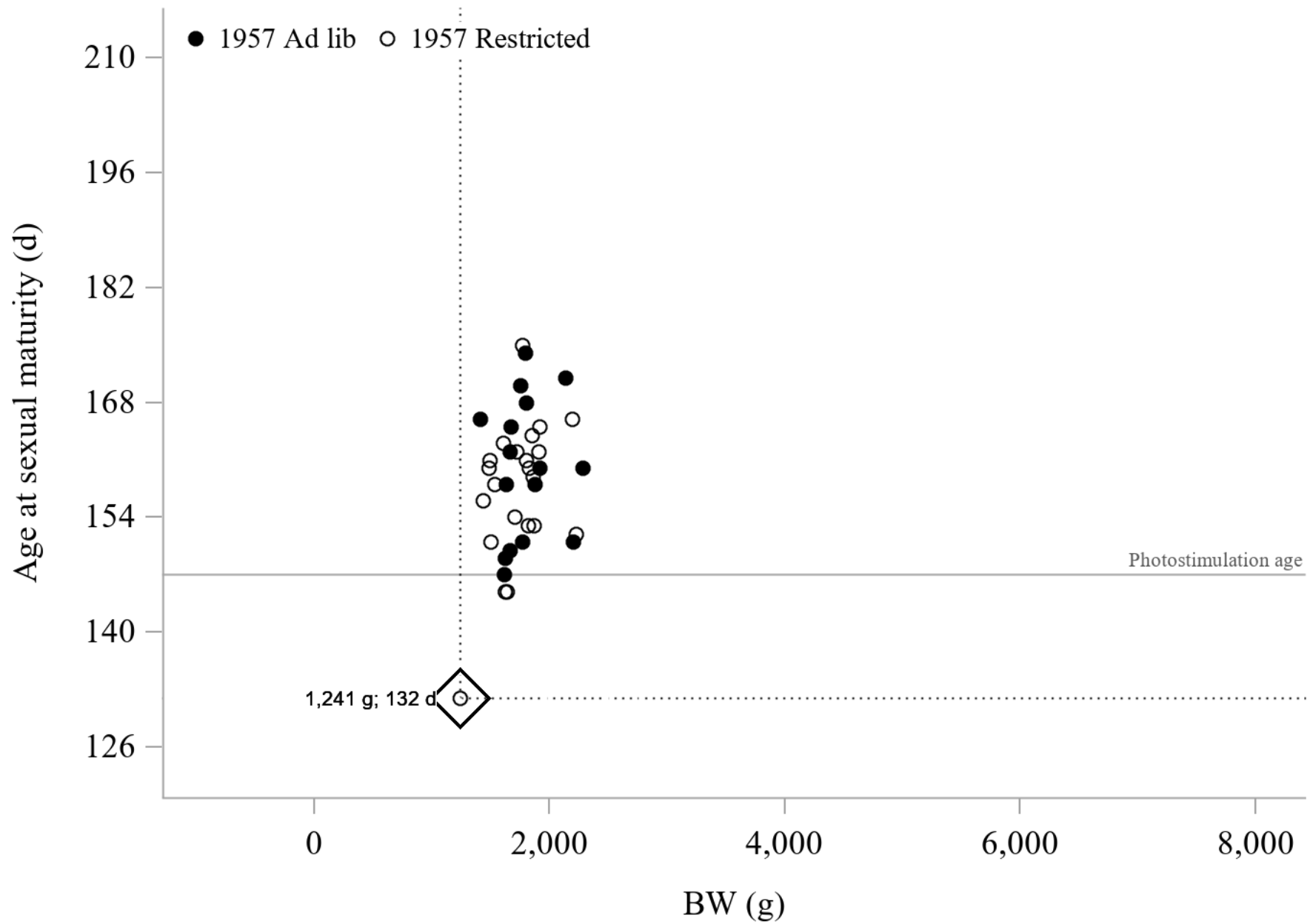
Abdominal fatpad at SM

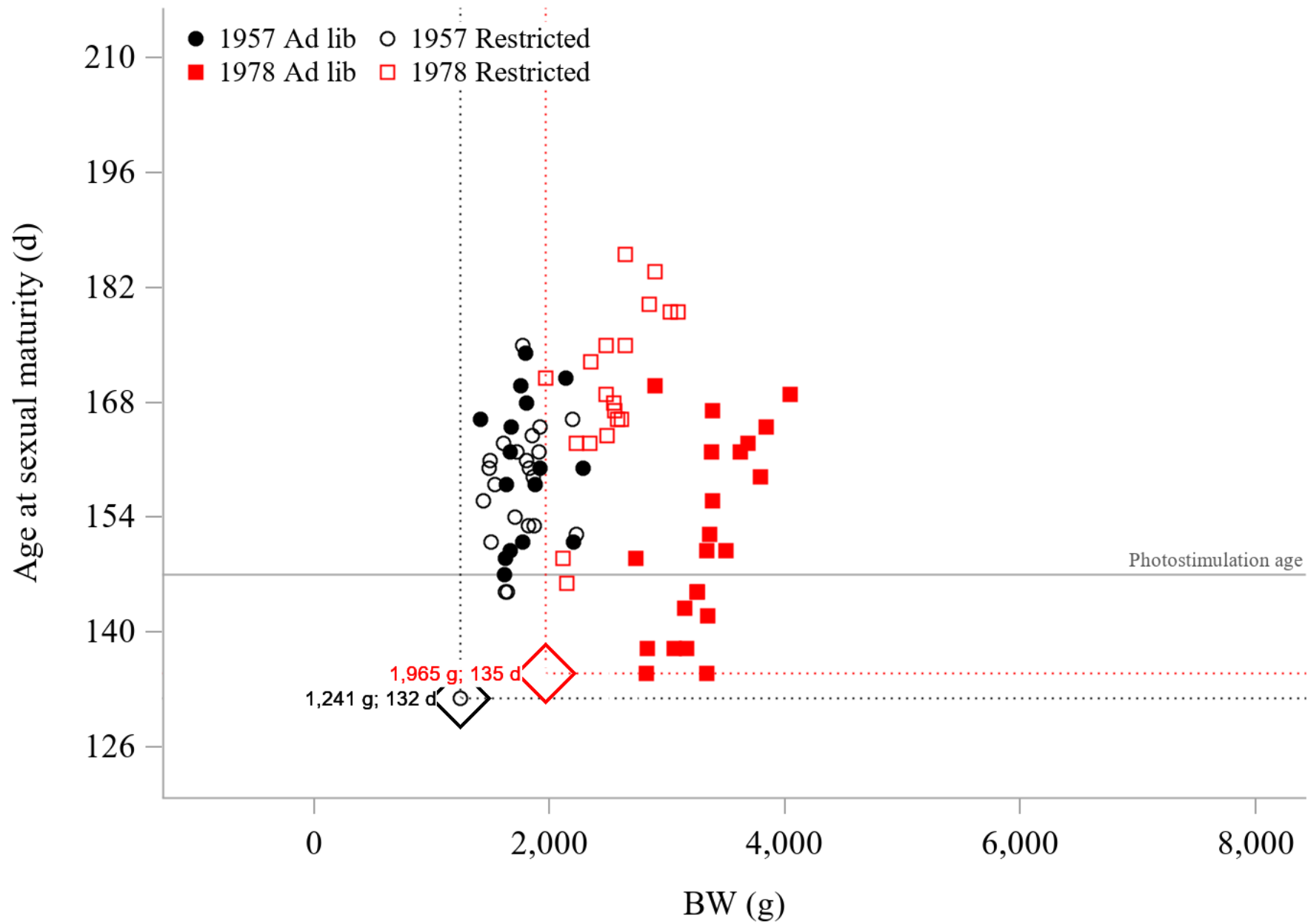


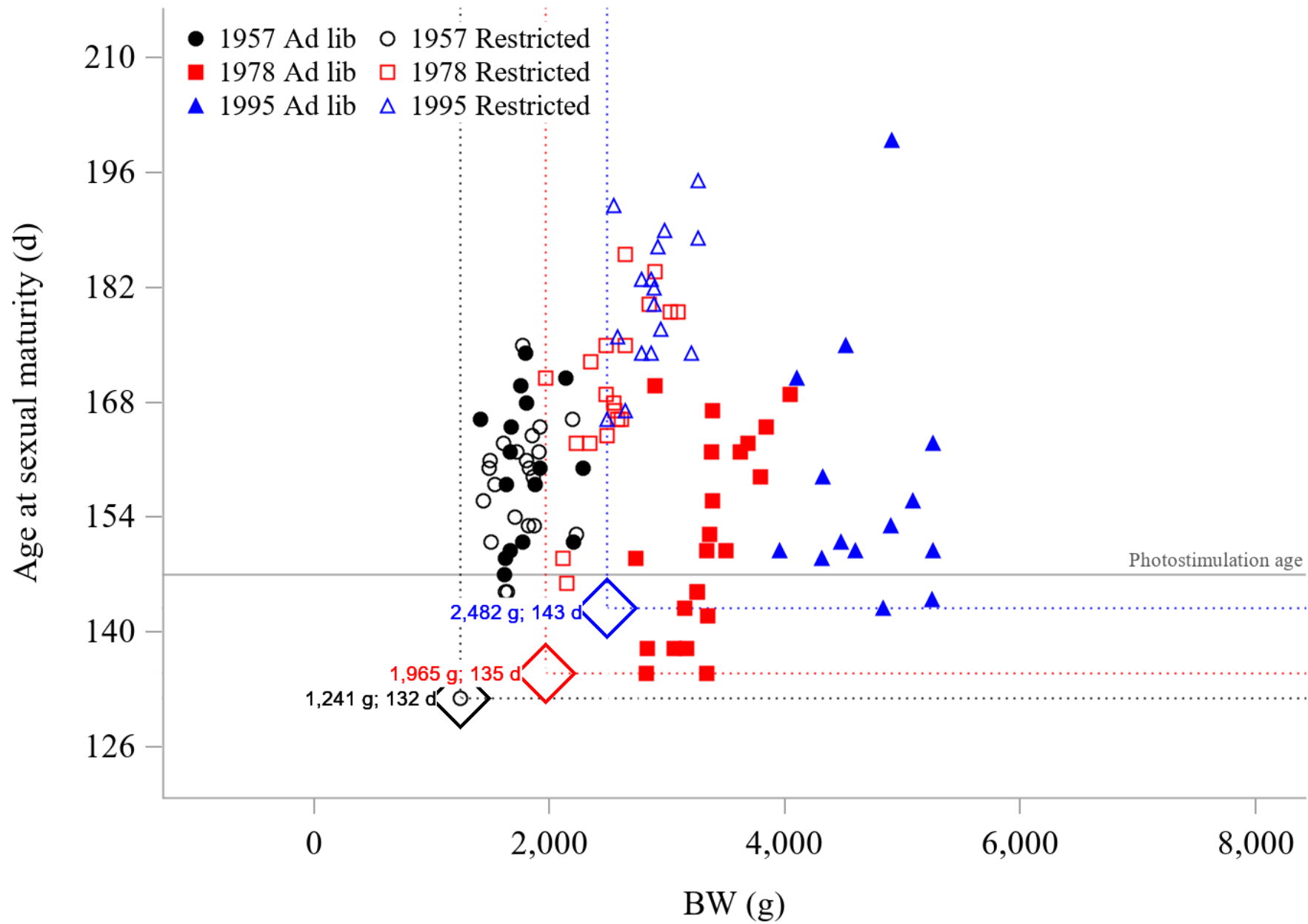
No. of Large Yellow Follicles

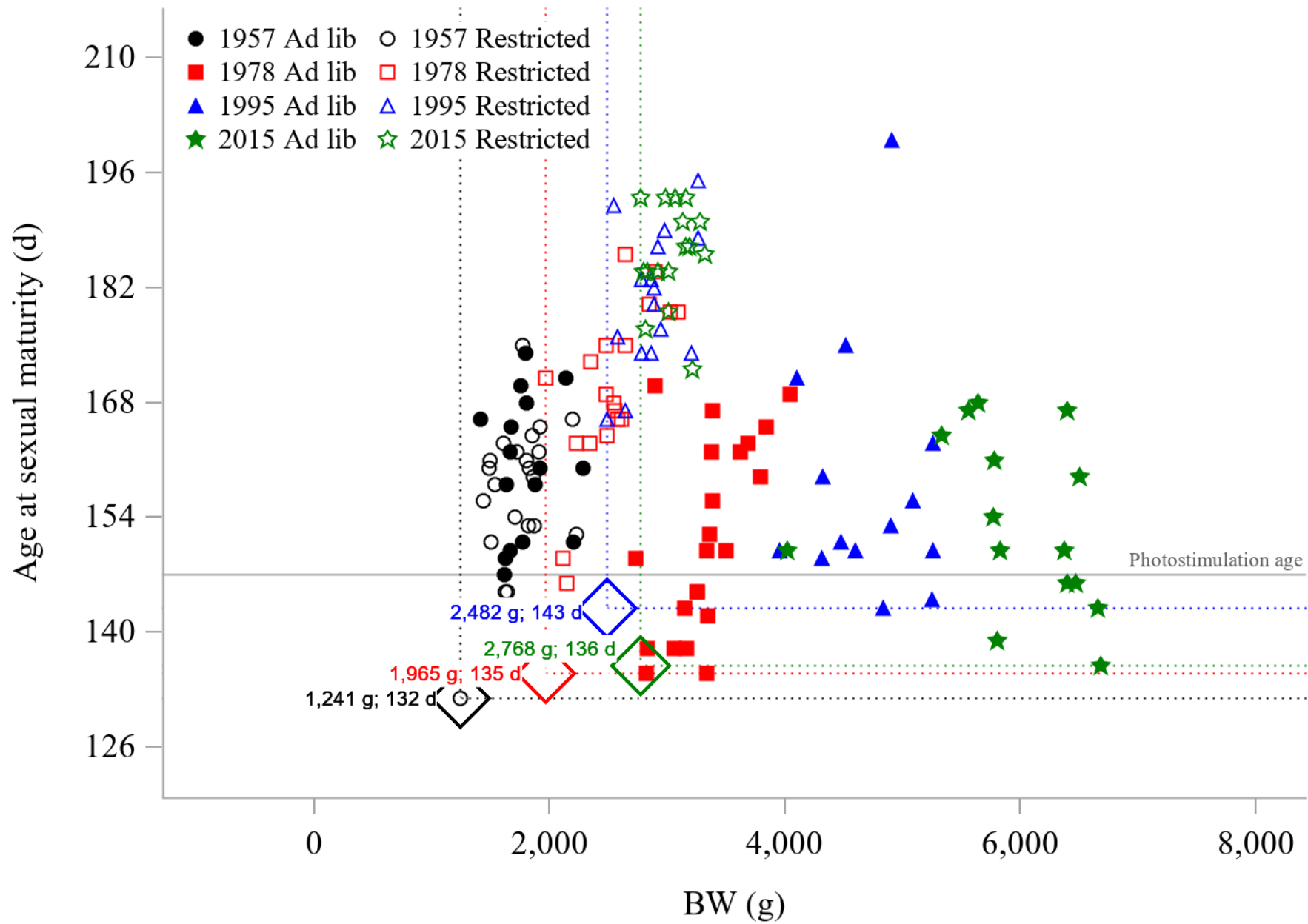




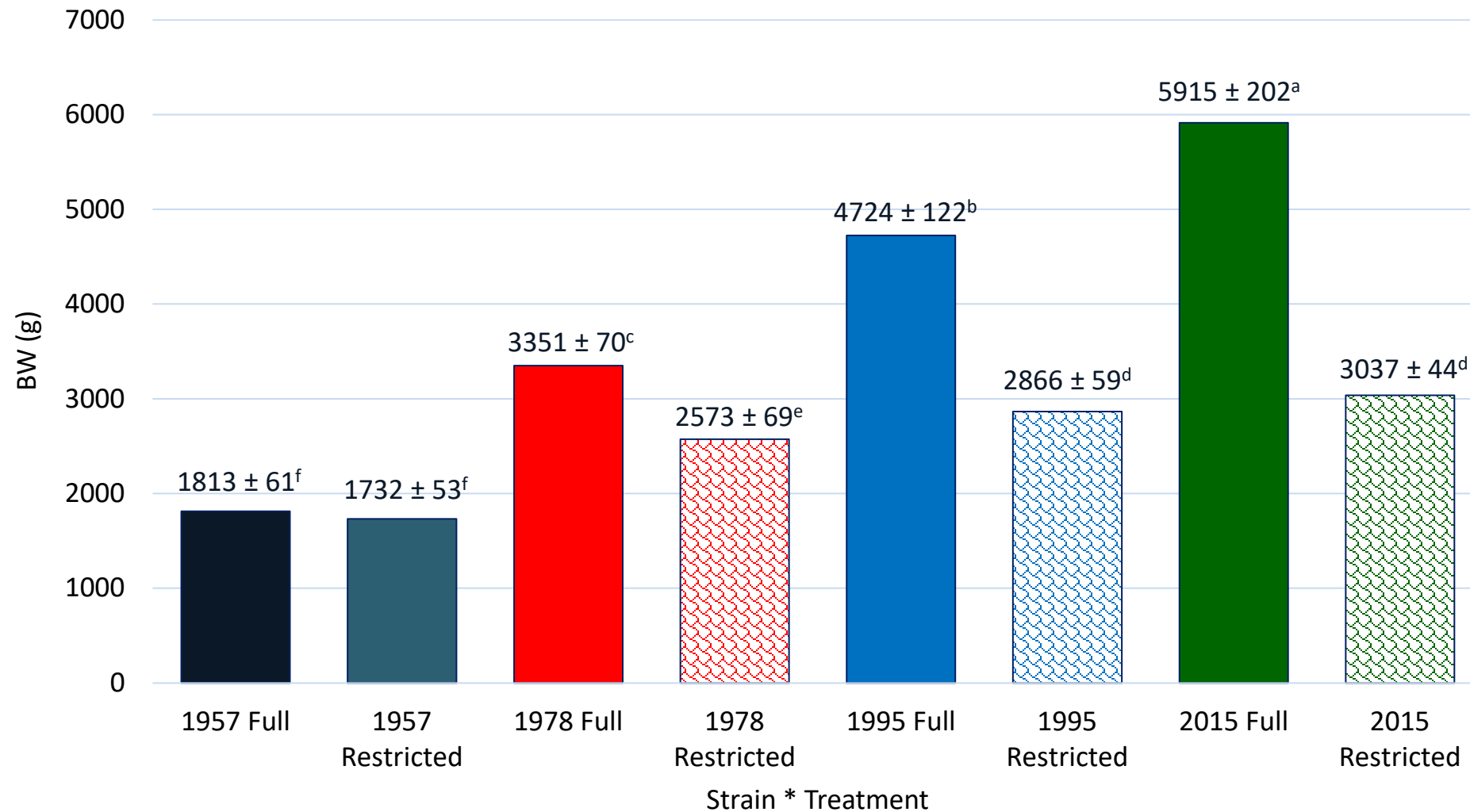




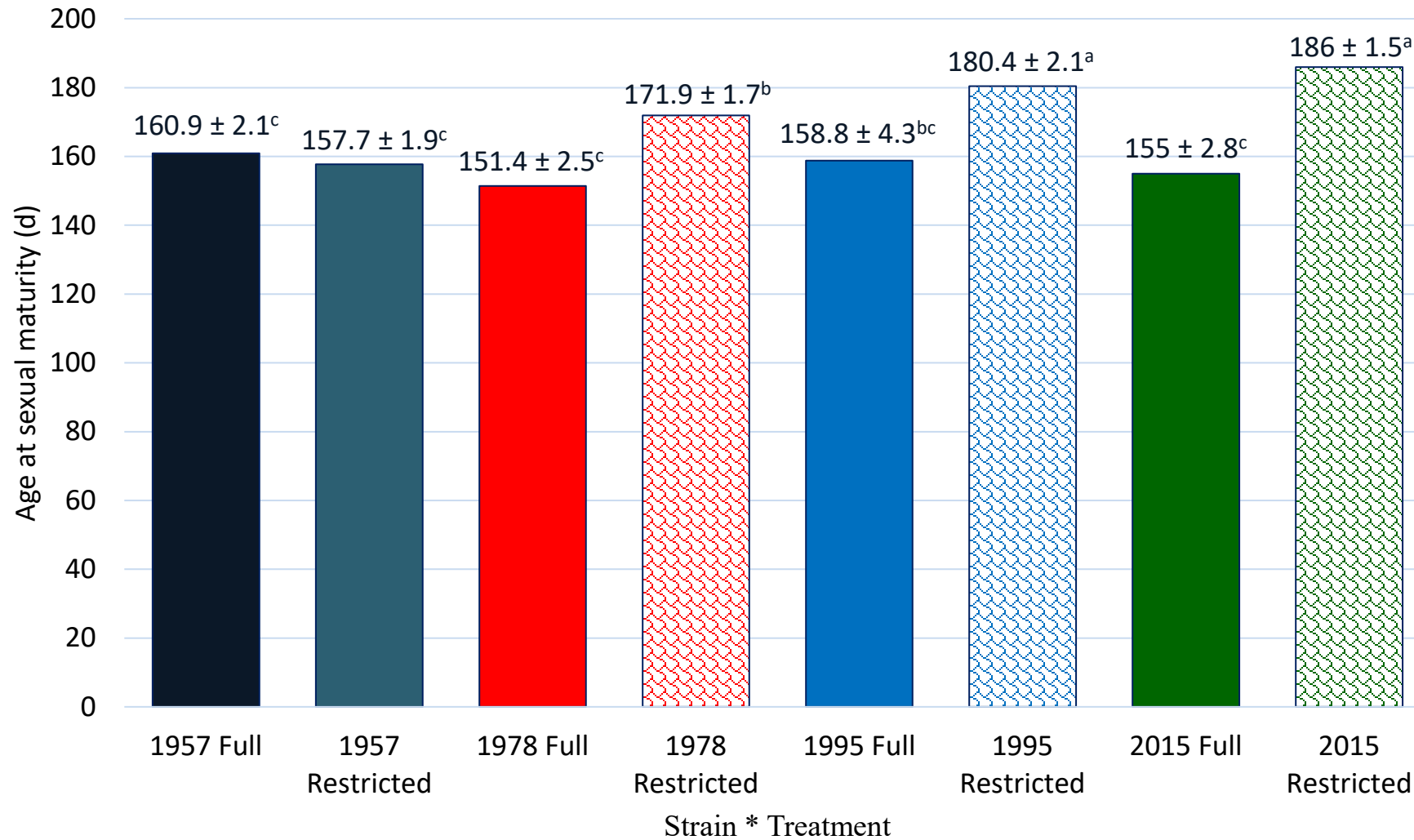




BW at sexual maturity



Age (d) at sexual maturity



So what consequences?



- ▶ Degree of Feed Restriction **↑**
- ▶ Carcass Fat **↓**
- ▶ BW threshold for puberty **↑**
- ▶ Age threshold for puberty **↑**

Genetic Potential

Field Performance

Management

Environment

Health

Nutrition

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