Nutritional flexibility of Charolais cows

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BACKGROUND

Beef cattle systems

→ Maximisation of fodder self sufficiency

→ Feeding management more economical and sustainable

Winter undernutrition is commonly used

French dietary guidelines for cattle (INRA 2007)

- Cows can be fed under their requirements

→ ***Abilities of cows to mobilize their body reserves, especially adipose tissues***

* Data largely refer to **multiparous cows**

Background

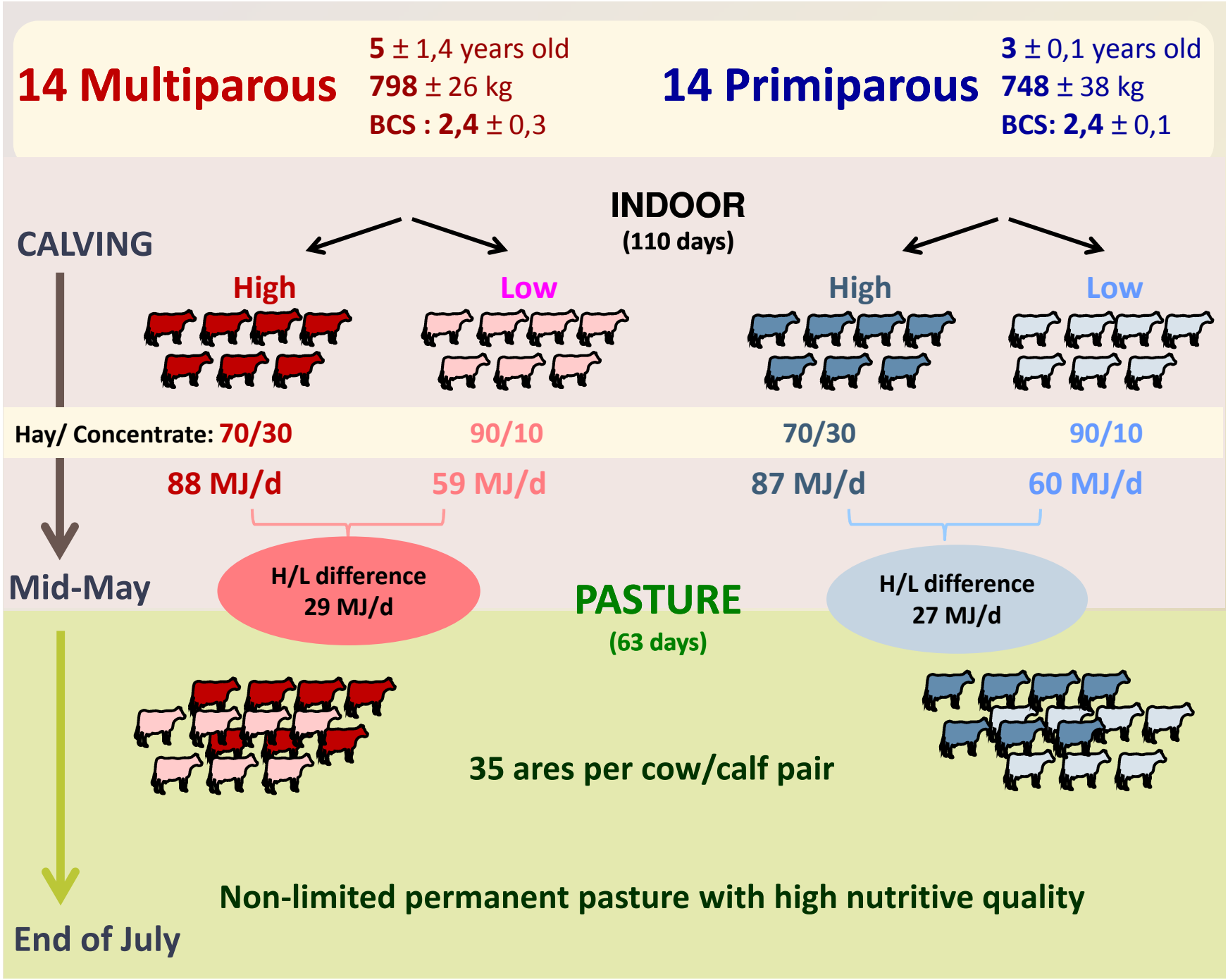
Under feeding restriction conditions

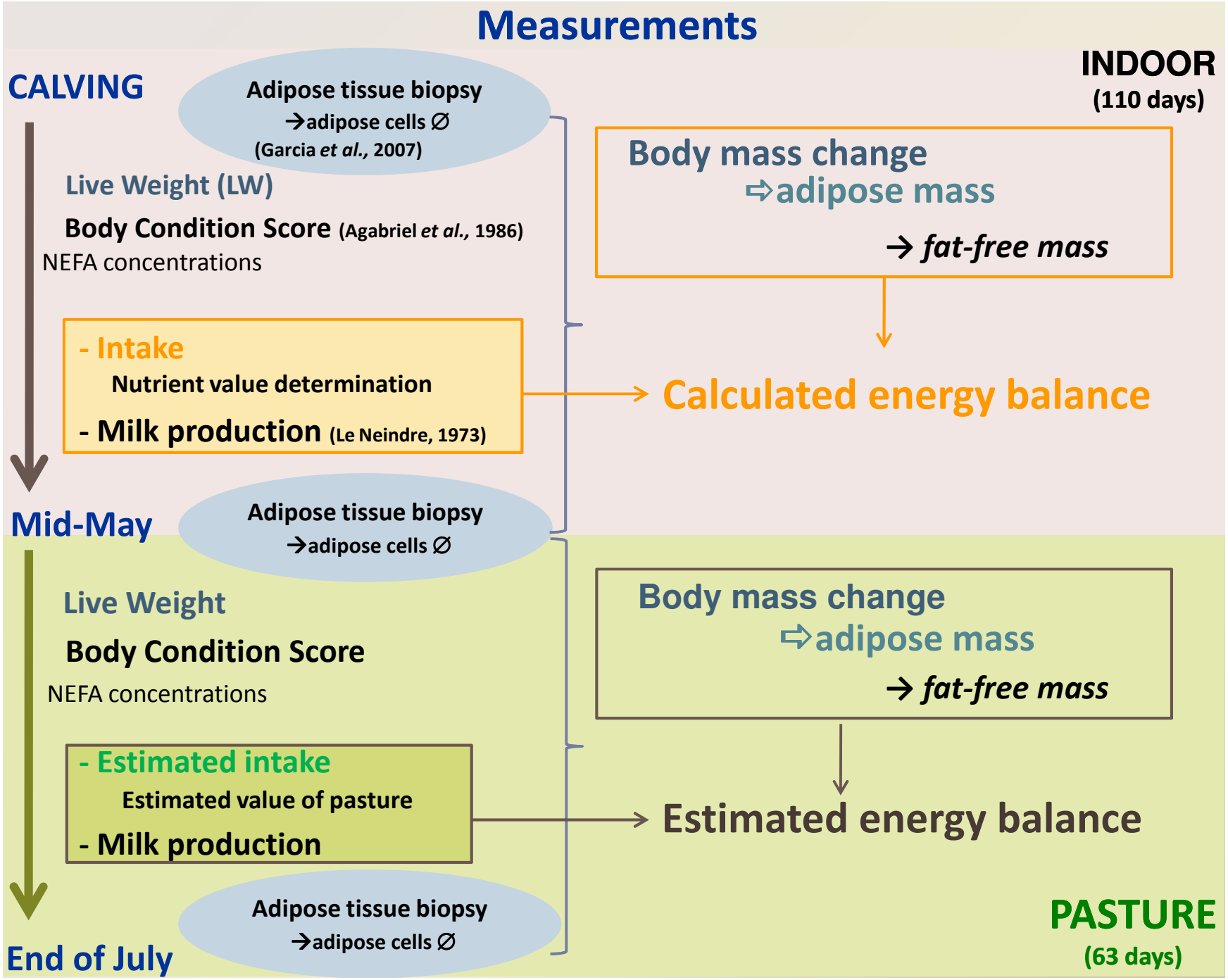
How Primiparous cow will manage

- **growth**
- **production**
- reproduction

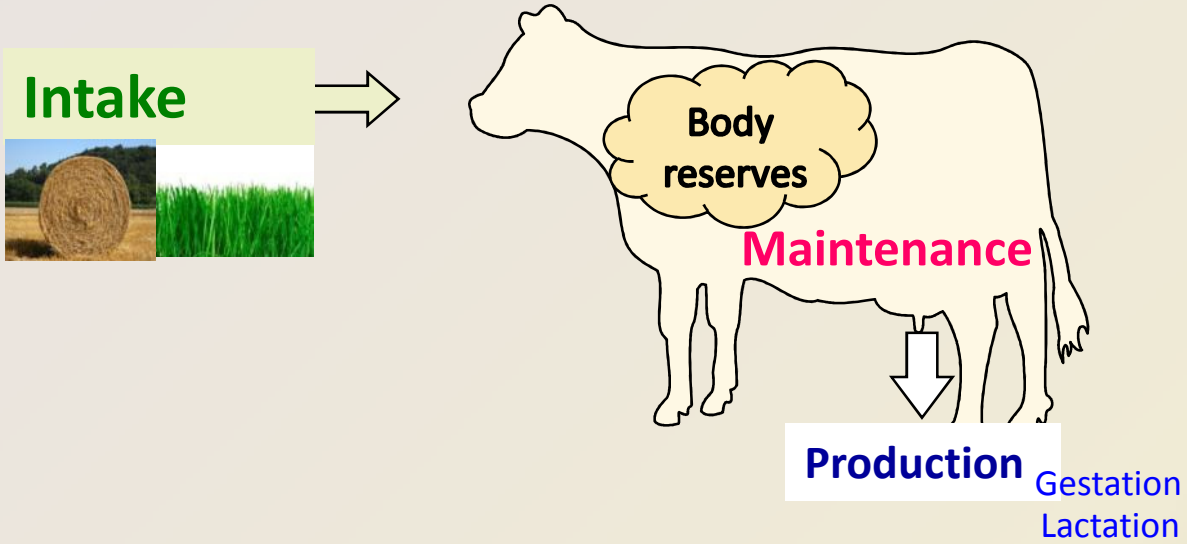
Post-partum adaptive response of primiparous and multiparous cows to a nutritional challenge ?

Experimental Scheme


14 Multiparous
5 ± 1,4 years old
798 ± 26 kg
BCS : 2,4 ± 0,3
14 Primiparous
3 ± 0,1 years old
748 ± 38 kg
BCS: 2,4 ± 0,1
INDOOR
(110 days)
CALVING
High
Low
High
Low
Hay/ Concentrate: 70/30
90/10
70/30
90/10
88 MJ/d
59 MJ/d
87 MJ/d
60 MJ/d
Mid-May
H/L difference
29 MJ/d
H/L difference
27 MJ/d
PASTURE
(63 days)
35 ares per cow/calf pair
Non-limited permanent pasture with high nutritive quality
End of July


Measurements
INDOOR
(110 days)
CALVING
Adipose tissue biopsy
→adipose cells ∅
(Garcia et al., 2007)
Live Weight (LW)
Body Condition Score (Agabriel et al., 1986)
NEFA concentrations
Body mass change
⇨adipose mass
→ fat-free mass
- Intake
Nutrient value determination
- Milk production (Le Neindre, 1973)
Calculated energy balance
Mid-May
Adipose tissue biopsy
→adipose cells ∅
Live Weight
Body Condition Score
NEFA concentrations
Body mass change
⇨adipose mass
→ fat-free mass
- Estimated intake
Estimated value of pasture
- Milk production
Estimated energy balance
End of July
Adipose tissue biopsy
→adipose cells ∅
PASTURE
(63 days)

Estimation of Energy available for maintenance (Eam)



E maintenance (MJ) = Intake – E production – E stored (or mobilized)

Hypothesis: No difference in nutritive values according to feed level

E milk = 3.2 MJ/kg

K tissues→ milk= 0.8

Δ kcal tissue = 9,37 x % lipids + 5,48 x % proteins

K lipid deposit = 0,8
K protein deposit = 0,6

INRA, 2007

E maintenance

theoretical value expressed in net energy of lactation MJ/d/kg^{0,75}

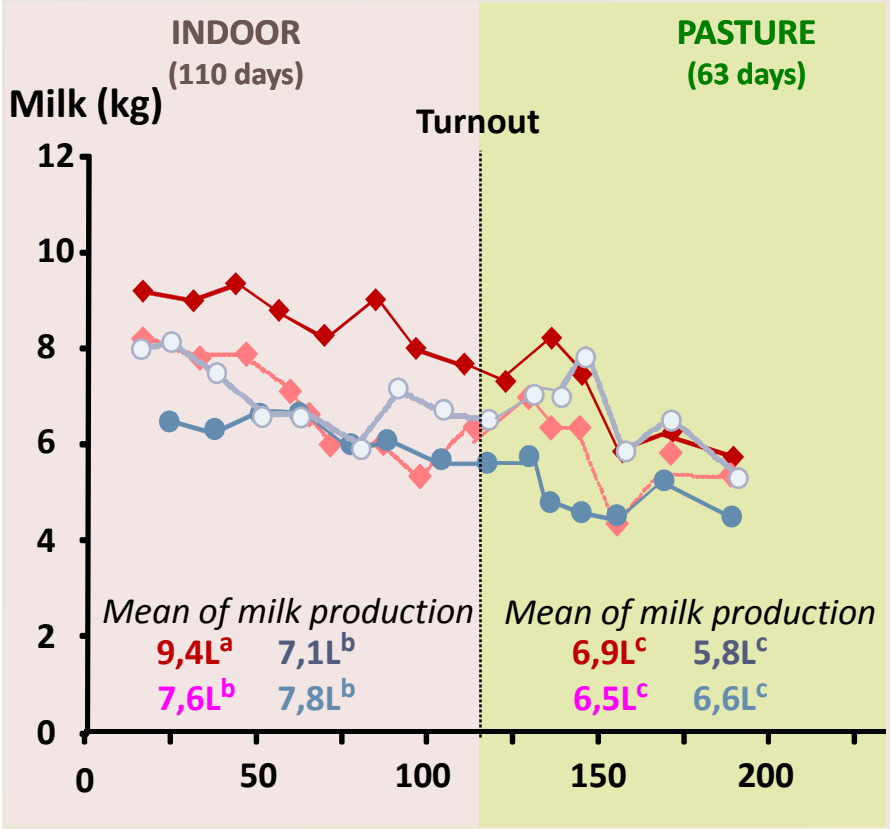
= 0.29MJ/d/kg^{0,75} + 10% in stalls or + 20% at pasture

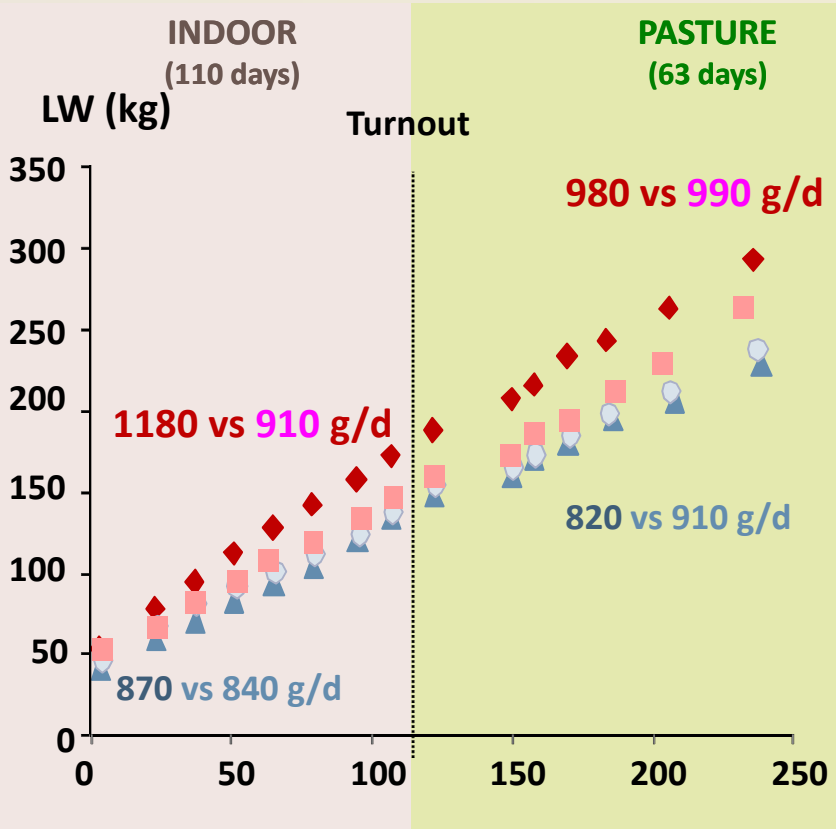
Results

Function of production:

Milk production and calves ' growth rate

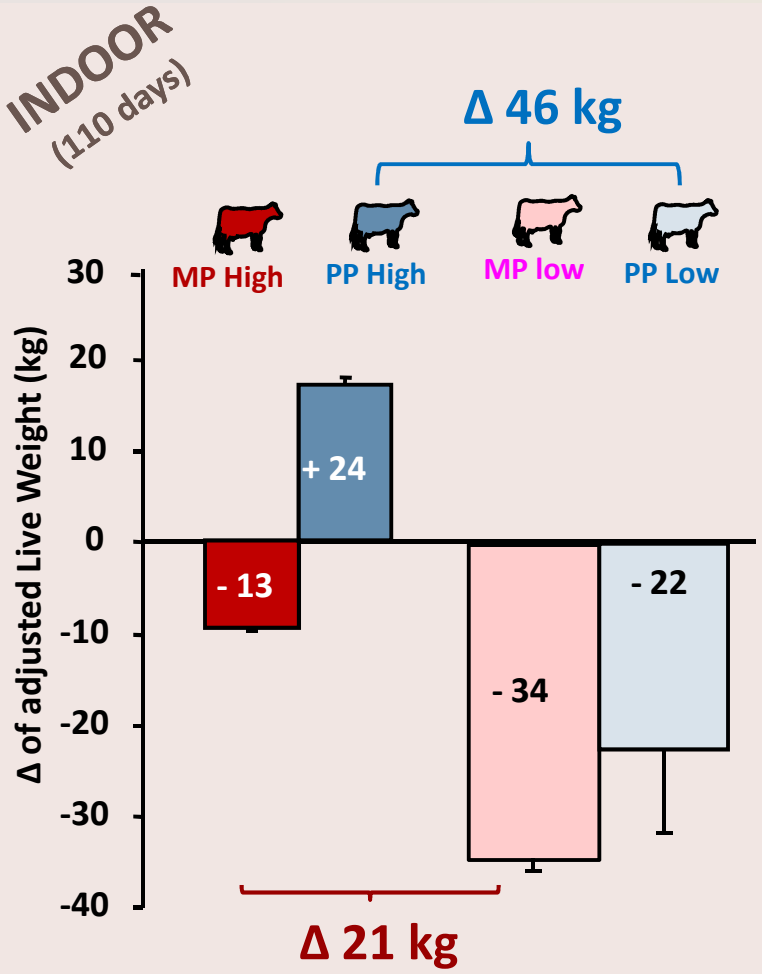
MP High PP High MP Low PP Low

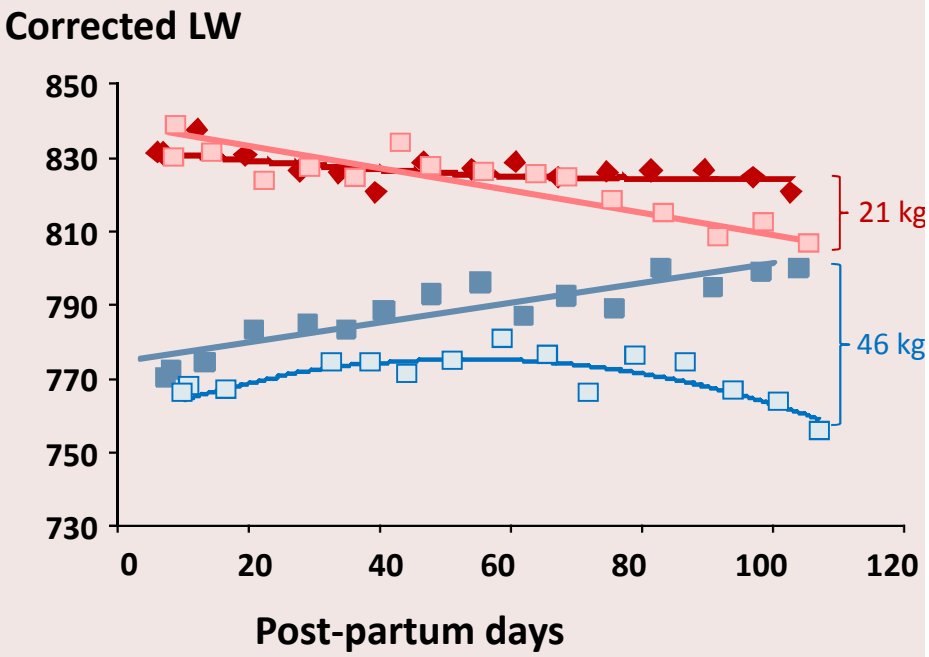




Nutritional challenge doesn't affect the function of production

Dynamic body mass changes

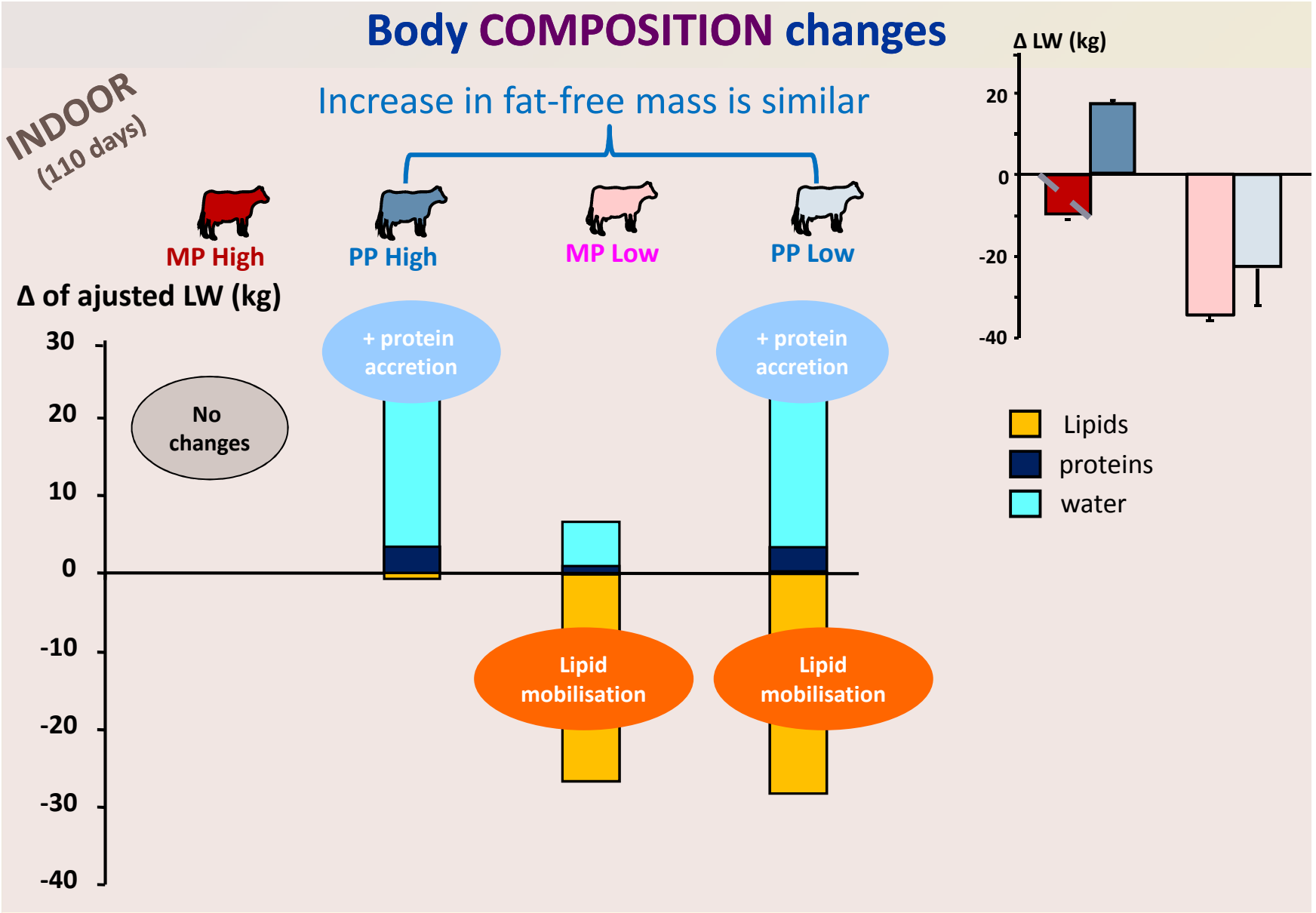




PP are more sensitive to the nutritional challenge than MP cows

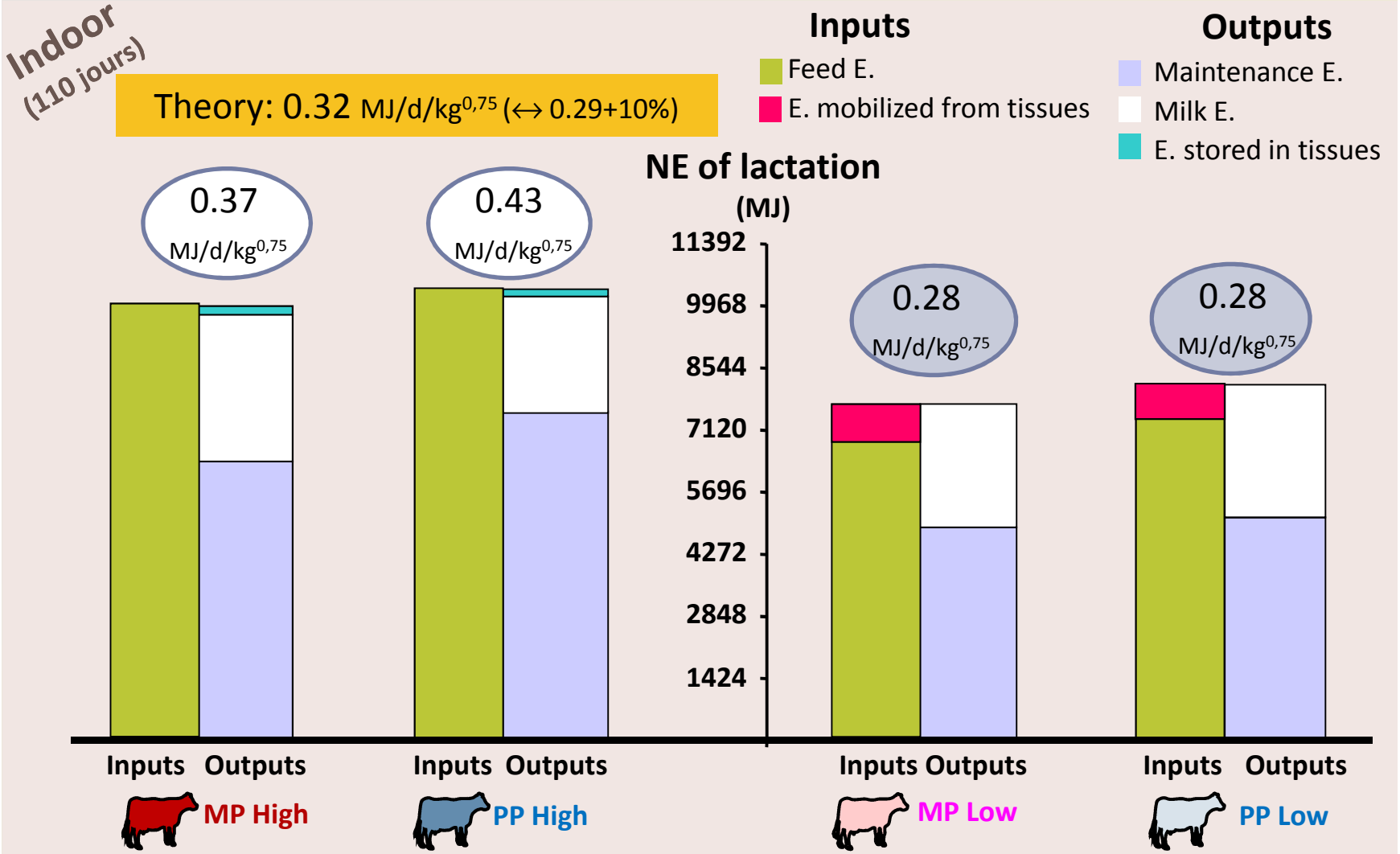
Dynamic weight changes differ according to the parity

Body COMPOSITION changes



Nutritional challenge doesn't affect the potential of growth of primiparous cows

Energy partitioning during indoor period



- **Nutritional challenge induces a metabolic adaptation: ↘ 30% Eam (0.28 vs 0.40)**
- **Eam differs from the theoretical value**

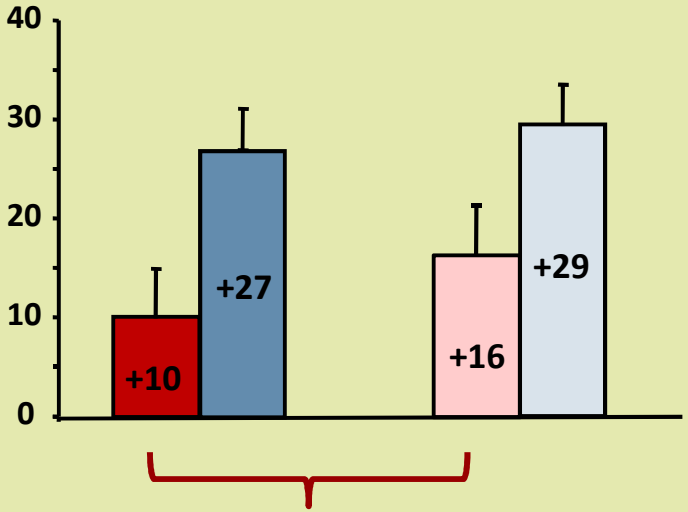
Dynamic body mass changes

Pasture
(63 days)

All cows grazed similar permanent pasture
No feed restriction

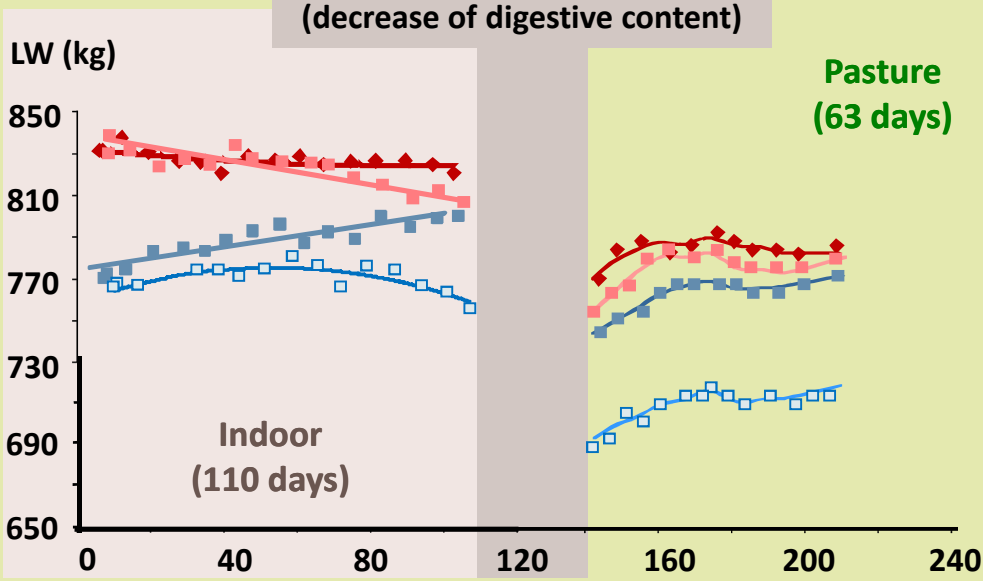
Δ2 kg

Δ of adjusted LW (kg)



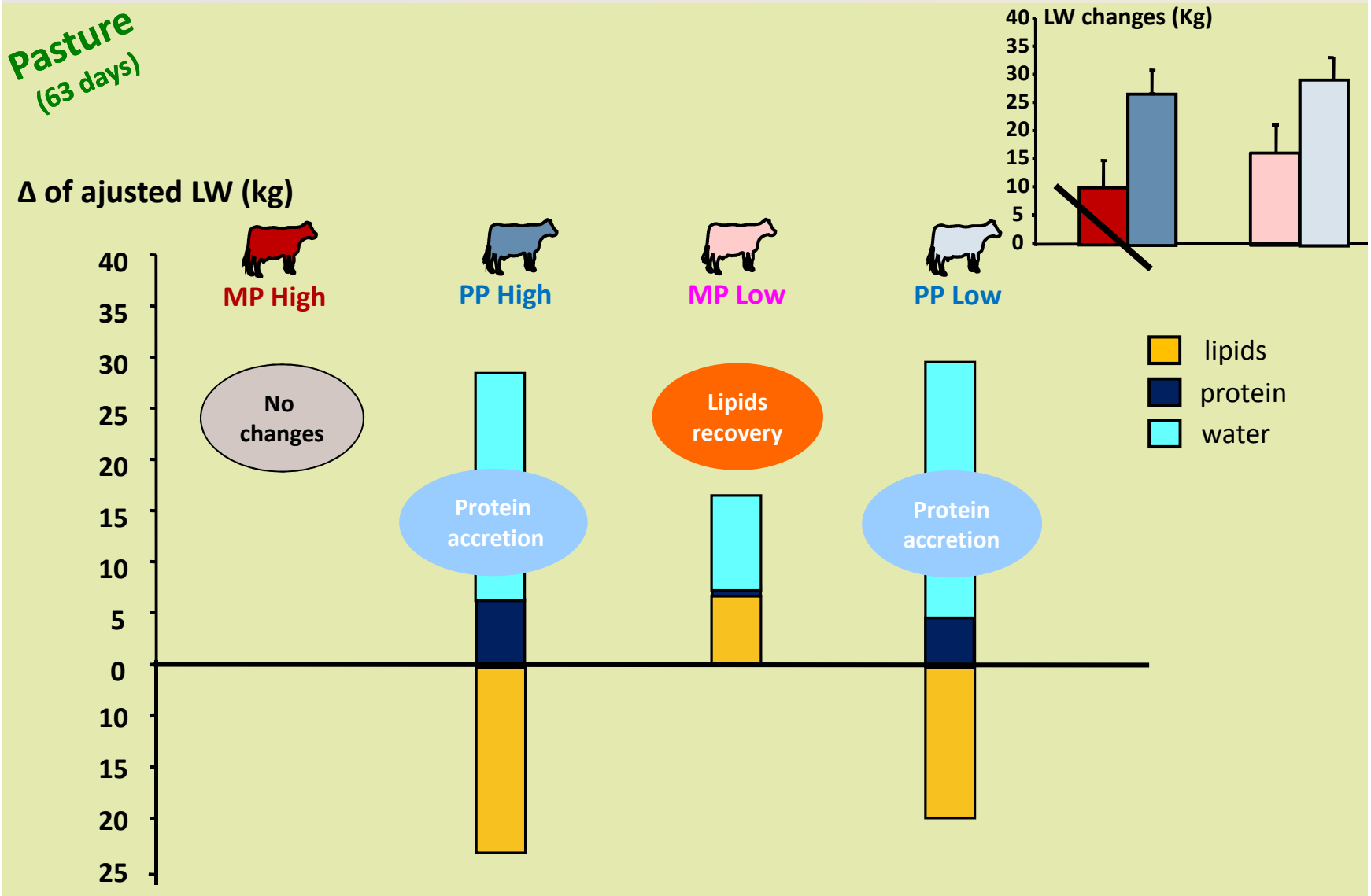
Δ6 kg

Transition period
(decrease of digestive content)



Body weight gain is observed in both PP and MP cows
Dynamic of body weight change is similar

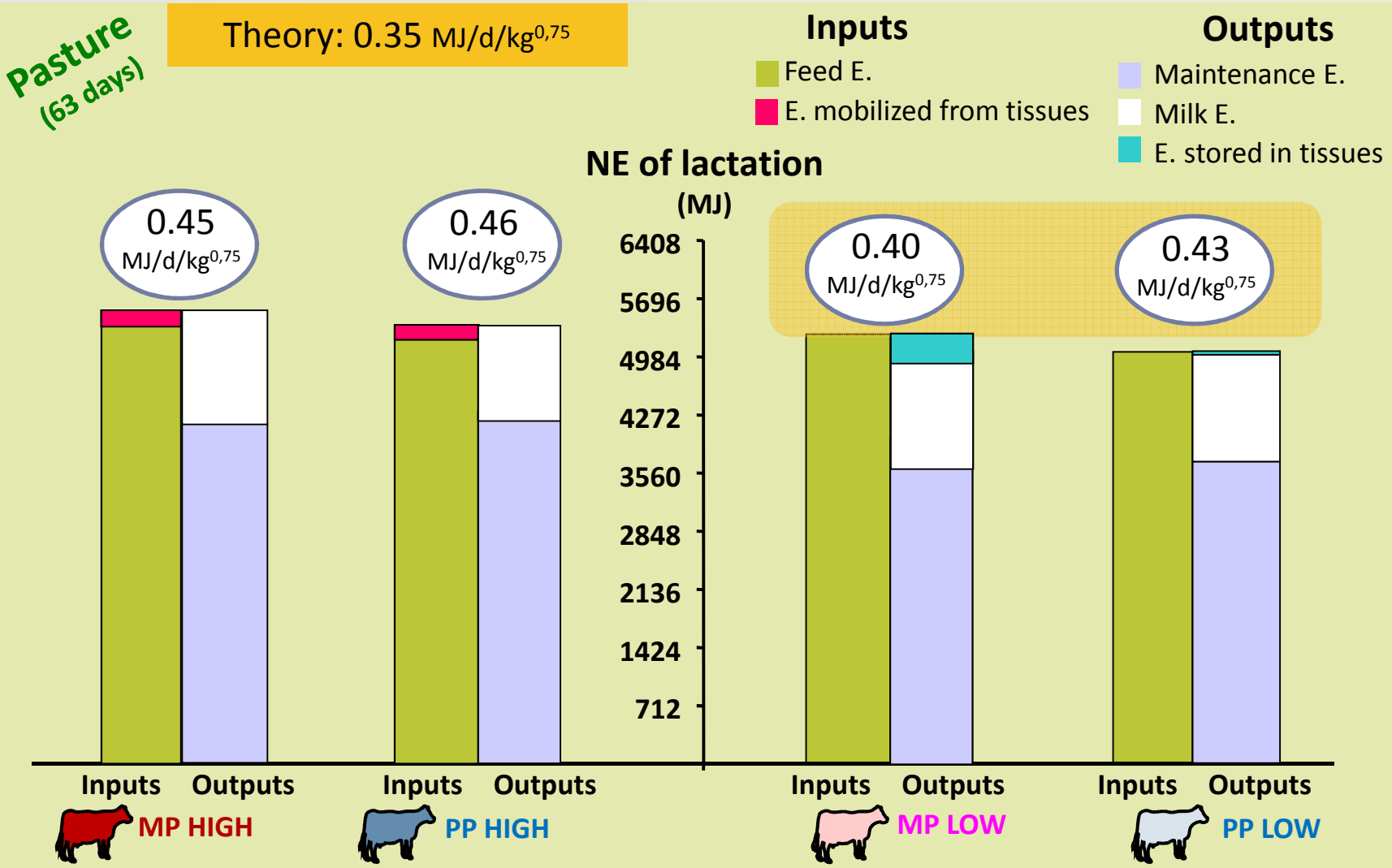
Body composition changes



At pasture : MPL cows recover part of their body lipids

PP cows continue to grow

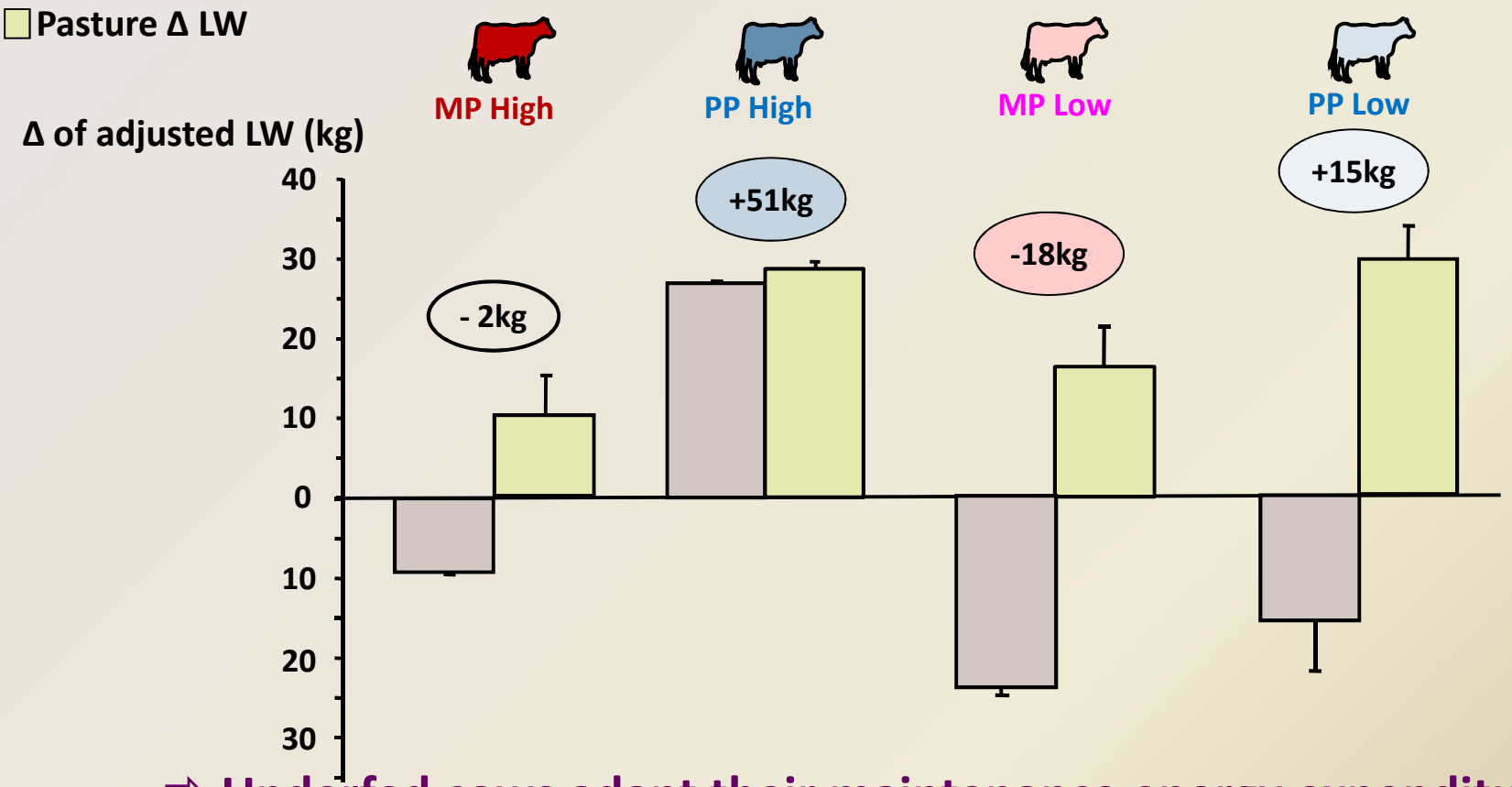
Energy partitioning at pasture



- **Eam is lower in winter feed restricted cows**
  → *retention of metabolic adaptation at least on the first part of pasture ?*
- **At pasture, Eam > theoretical value +20%**

Conclusions

Conclusions



⇨ **Underfed cows adapt their maintenance energy expenditure**

- Function of growth remains priority

What could be the adaptive response of primiparous cows ?

- **younger, early maturing breed, minor body development and/or BCS**
- **longer feed restriction period (from housing to turnout)**

Perspectives

⇨Differences between observed and theoretical values

Improvement of energy for maintenance prediction

⇨Take into account the energy balance changes during the production cycle

Development of a dynamic predictive model of energy partitioning in beef cows

Thank you…

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