Variable nutritional trajectory contributes to the robustness of beef cows whatever their body condition at calving

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_01 Context

Beef suckling cows
& french beef cattle production systems

Charolais cows : late maturing beef breed
carcass weight ≈ 450 kg

The concept of ROBUSTNESS :

Numerous definitions

The robustness is a property that accounts of the ability of a system to maintain its function despite external or internal perturbations

Kitano, 2004

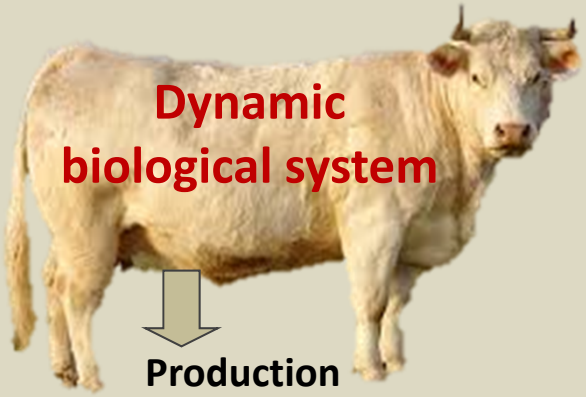
⇨ **At the animal level, the robustness is defined as its ability to maintain its functioning and being resilient when facing environmental disturbances**

Strandberg, 2009

⇨ Such a capacity relies on **adaptive abilities** of animals that may involve **trade-off between life functions** when environment becomes limiting

From a systemic point of view

In changing environment



Main biological functions

- growth, maintain itself
- produce
- reproduce

} Over a productive cycle

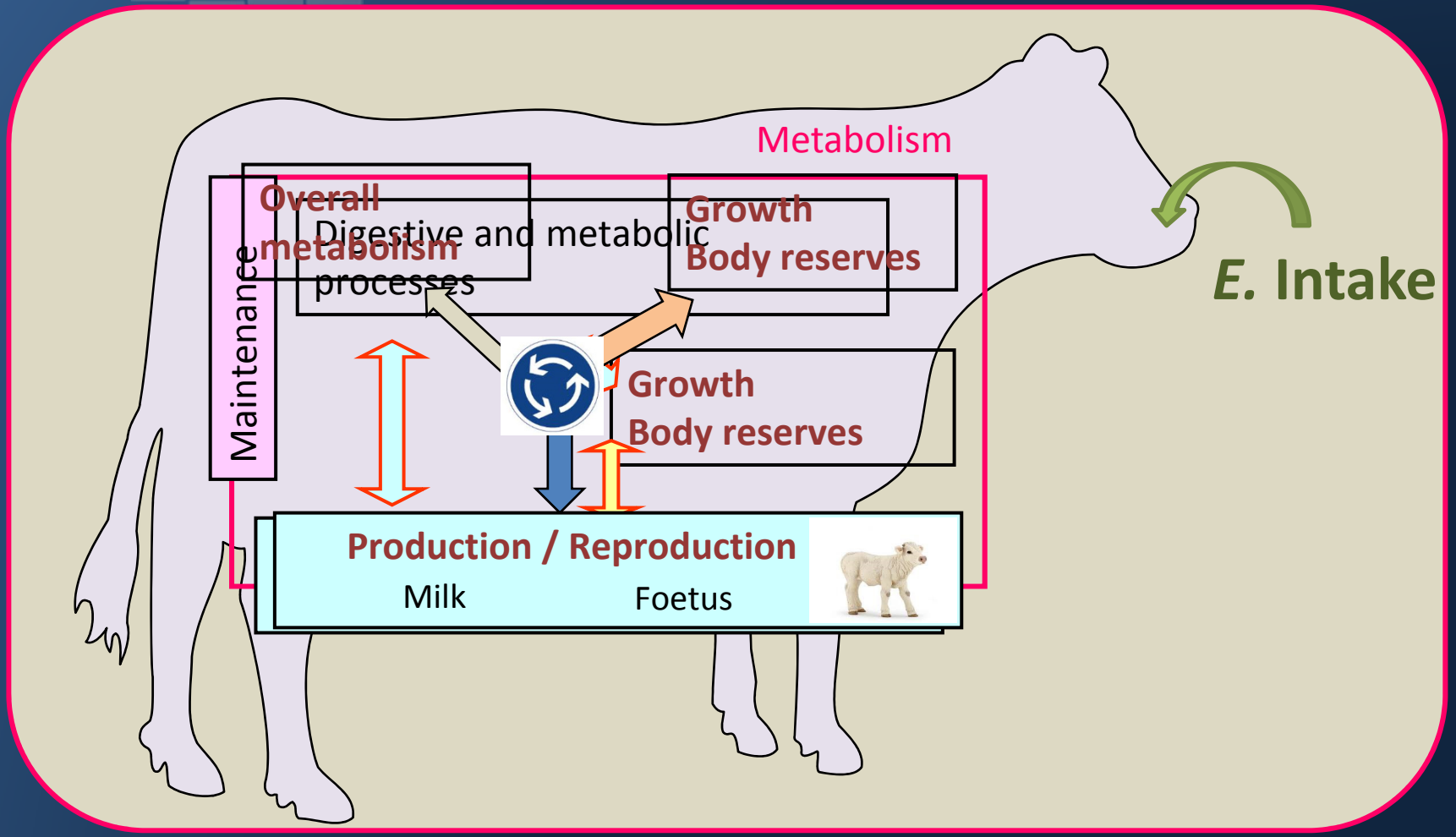
⇨ Trade-off between functions

⇨Cows have to reach an optimal resources allocation to achieve functions whatever the environmental constraints

That question has been considered in high-producing dairy cows
(Kirkland and Gordon, 2001
Friggens and Newbold 2007, Martin and Sauvant, 2010…)

Robustness of suckling beef cows ?
What indicators ?

The cow as an active system



Eresidual = E intake – E (production and tissue growth)

Objectives :

To propose an indirect approach to apprehend robustness in beef cows

⇨**Differences in Eresid** between cows experiencing from calving a **variable nutritional trajectory** and cows subjected to a **non limiting (=stable)** nutritional trajectory

⇨Test the **impact of initial body condition at calving** on *E*resid

_02

Material and methods

The nutritional challenge

involving adaptive response to changing environment

Constraining period
(120 days)

40 multiparous charolais cows

Calving (d 0)

Feeding Energy level

Requirements

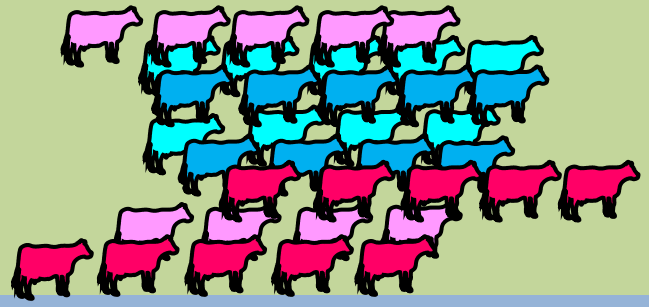
d 120

Fat cows
(BCS = 2.8 ± 0.08)

Thin cows
(BCS = 2.0 ± 0.04)

Stable	Variable	Stable	Variable
FS (n=9)	**FC** (n=9)	**TS** (n=9)	**TV** (n=10)
120%	70%	120%	70%
39 MJ/d		*36 MJ/d*	

Recovery grazing period (76 days)



40 ares per cow/calf pair

Non-limited permanent pasture with high nutritive quality

Calculation method

expressed in ***Net Energy for lactation in MJ***

Working hypothesis

$$E_{resid} = E_{intake} - E_{lactation} - E_{foetus} +/- E_{mobilized\ /retained\ tissues}$$

measured | measured | = 0 | calculated

Constraining period

Feed offered and refused

calculated

- Weight-suckle-Weight method (Le Neindre, 1973)

→**E lact. = 3.2 MJ x kg of milk drunk**

- Adipose cell size measurements
- Allometric equations (Robelin & Daenicke, 1980)
- Compocow model (Garcia & Agabriel, 2008)

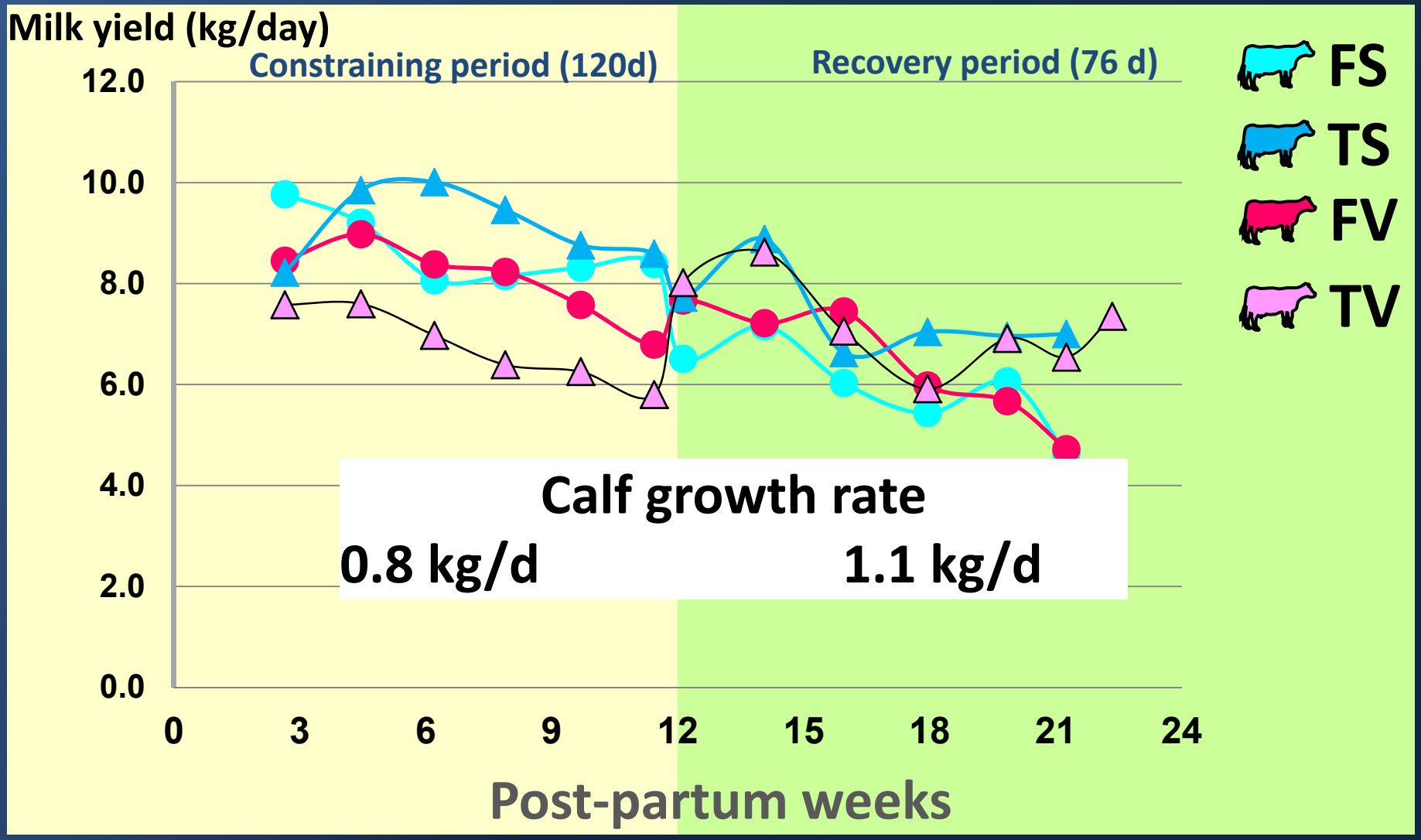
Recovery Period

Estimation of individual intake of grazed grass using fill unit system (Faverdin et al, 2011)

NE tissues for 1 kg body mass change = 66.7MJ x %lipids + 39MJ x %proteins

_03 Results

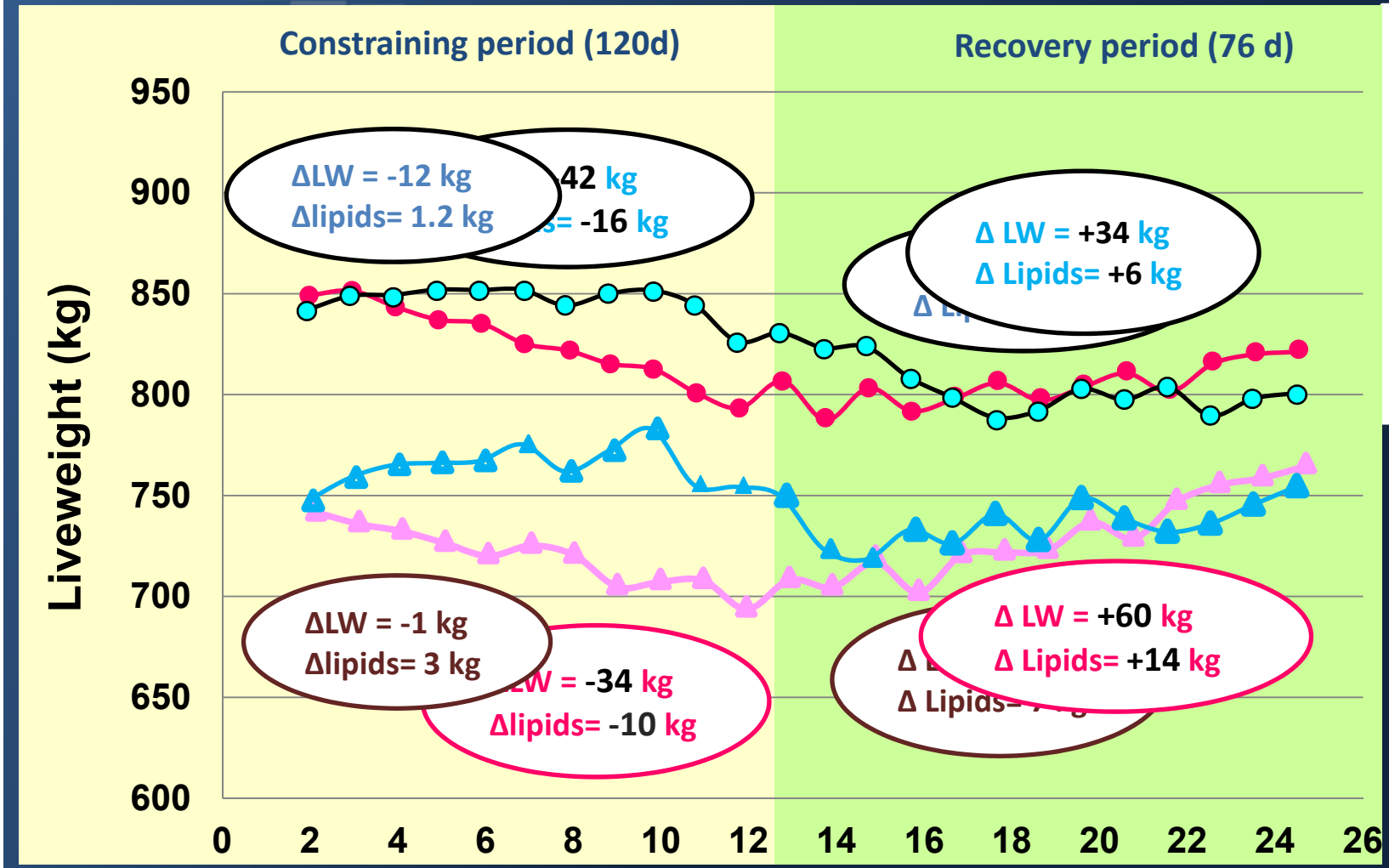
Milk production & ADG of calves



Milk production is maintained
suggesting the priority of lactation function in beef cows

Body composition changes

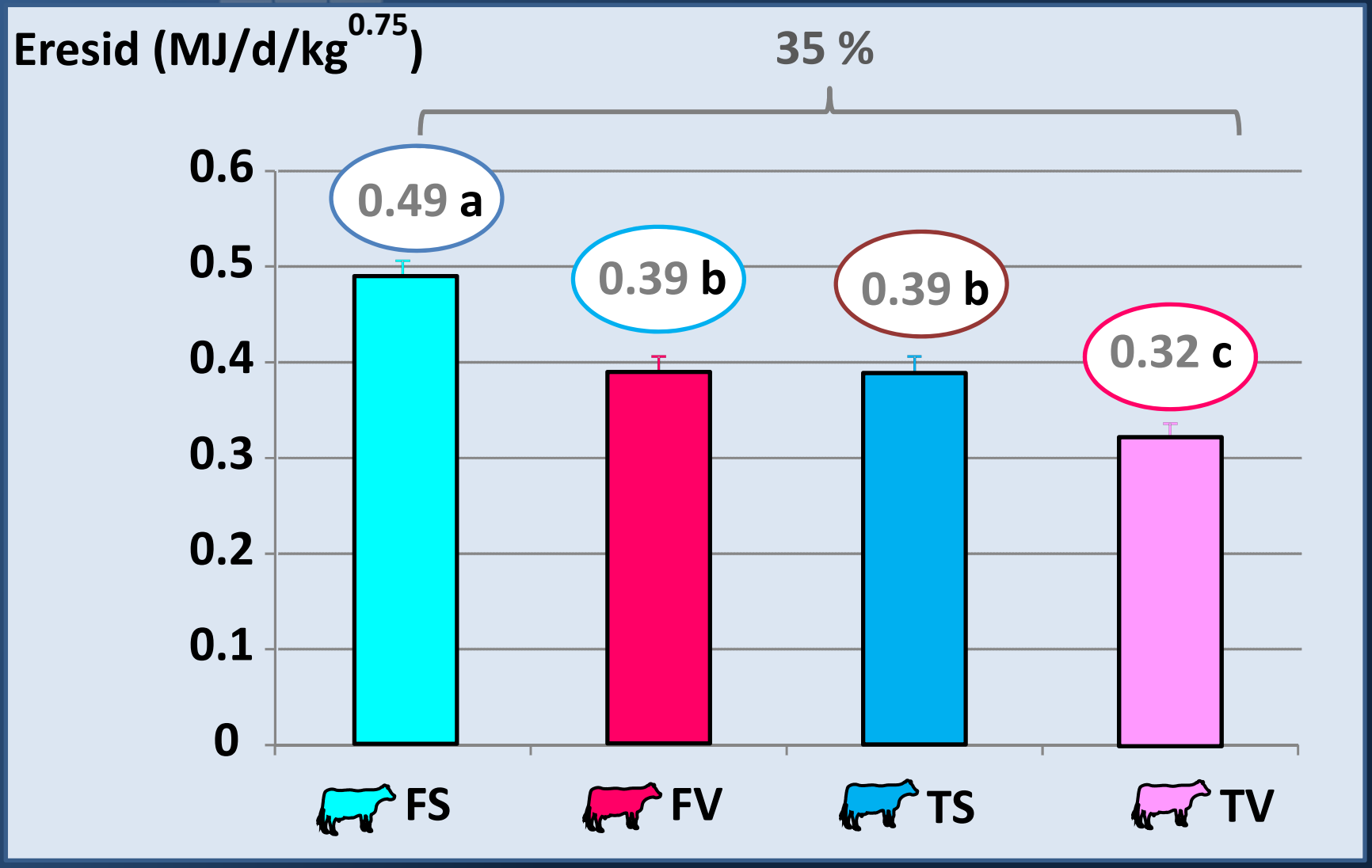
Over the nutritional challenge (196 days)



End of the nutritional challenge : recovery of LW and body condition

→ adaptive trajectories : mobilization and reconstitution of body reserves

Eresid variations over the nutritional challenge (196 days)

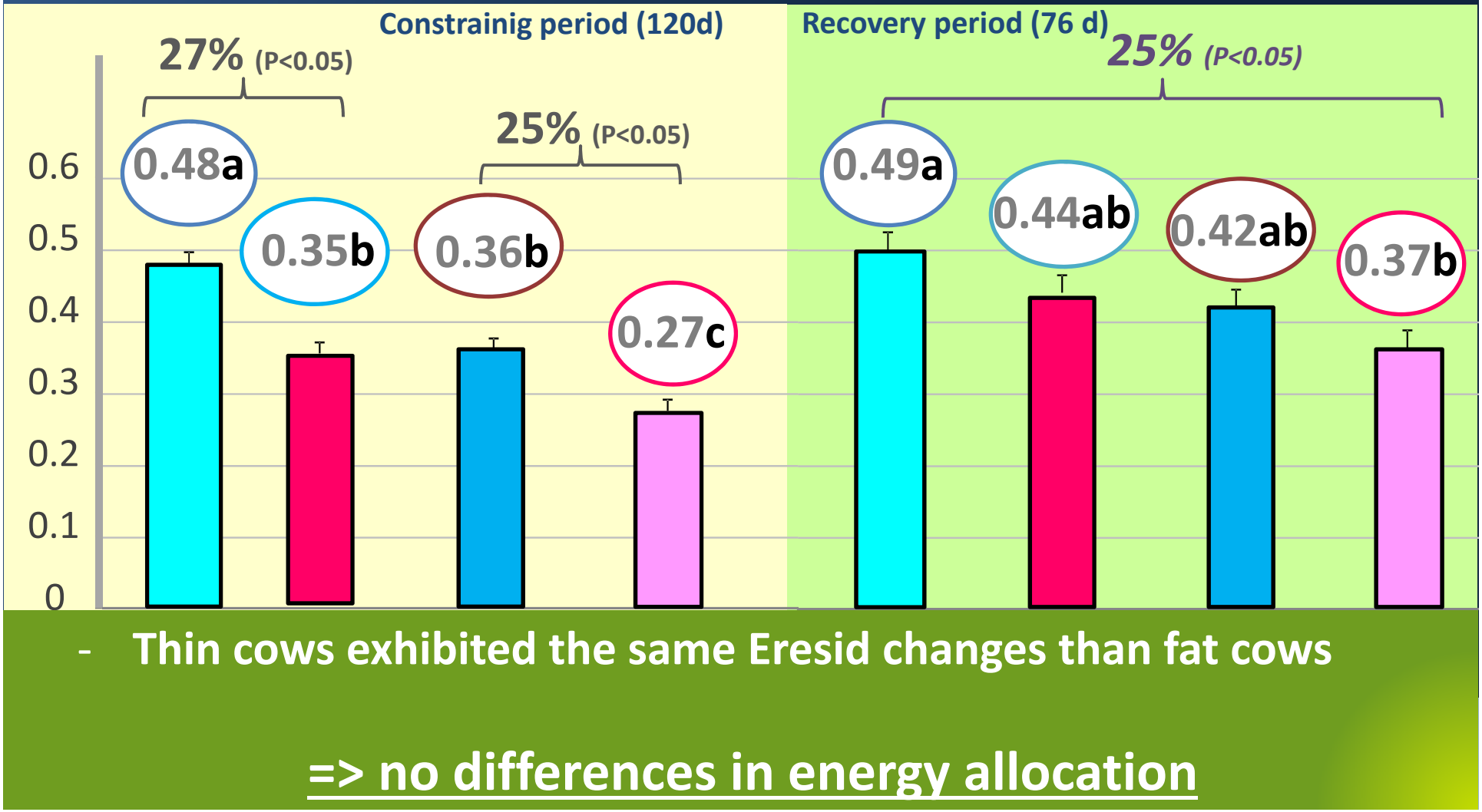


Δ Eresid = 35% according to energy level and body reserves at calving

Energy allocation in Fat and Thin cows

⇨Energy put in milk is similar between groups (≈ 30% Eintake)

⇨Body reserves buffer differences between energy supply and requirements



- **Thin cows exhibited the same Eresid changes than fat cows**

<u>=> no differences in energy allocation</u>

_04

Conclusions / Perspectives

Eresid changes over productive cycle

⇨ **Ability of beef cows to maintain milk production in changing environment**

⇨ Our experimental design allows to observe **Eresid changes**

⇨ **ΔEresid : 35%**

⇨ **Eresid changes could be an indirect criteria of robustness since reflect safeguarding energy allocation to life functions**

↳ **Further investigations to validate :**

↳ Relevance of Eresid as a trait of robustness in changing nutritional environment

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NUTRITIONAL CHALLENGE