Dairy cows' diet has a marked impact on vitamin content in milk but less in yogurts

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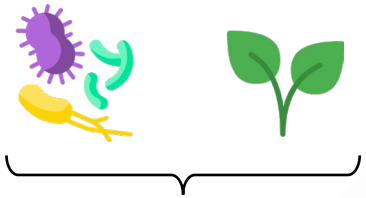
3rd September, 2024 – Firenze, Italy

B vitamins : *Description and needs*

Clinical deficiencies in disadvantaged populations
(Allen et al., 2003)

Subclinical deficiencies in the rest of the population
(Cordero et al., 2008)



Metabolic pathways

Coenzyme, Energy, fatty acid,nucleic acid, protein and sugar metabolism
(Graulet, 2014)

B vitamins

↓

Need to be supplied by food for humans

Milk = source of B vitamins

Consumer products
(Coudray et al., 2011)

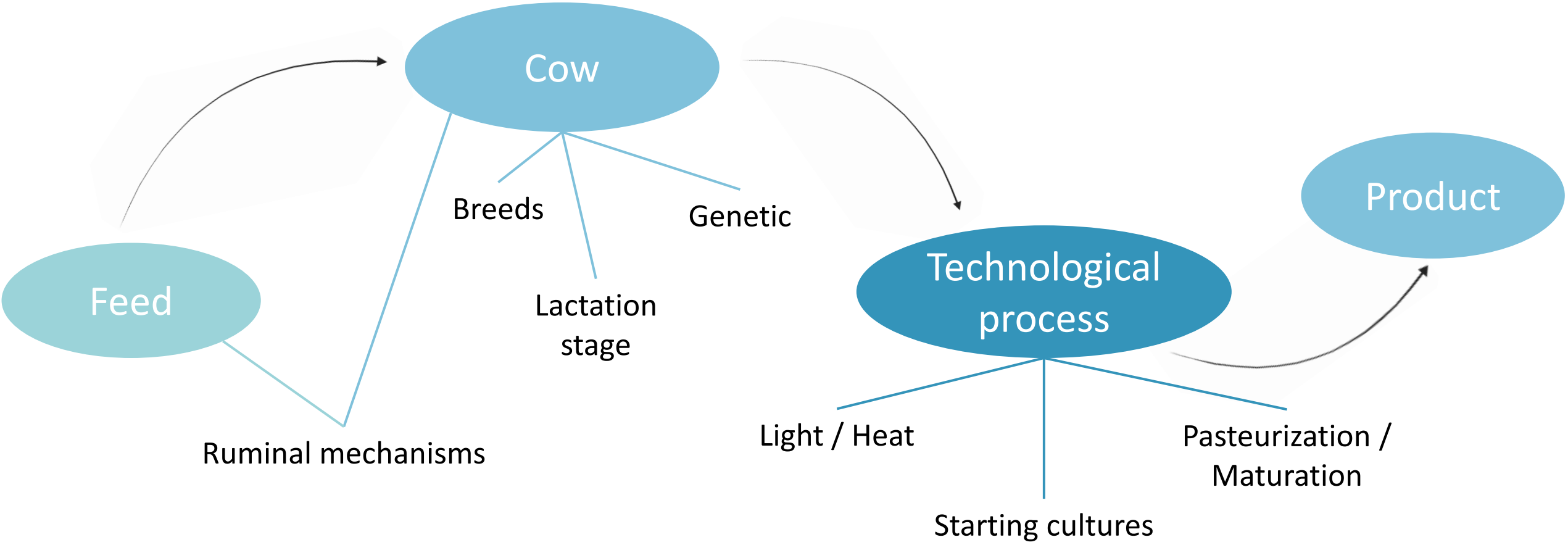
Nutritional interest
(Graulet, 2014)

Dairy products could improve the status of B vitamins in humans

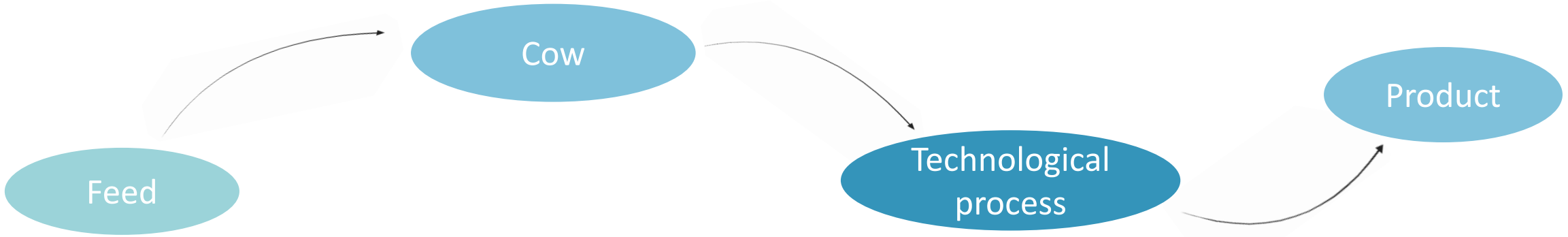
↓

What are the factors impacting B vitamin level in dairy products ?

B vitamins content variations : *the drivers*



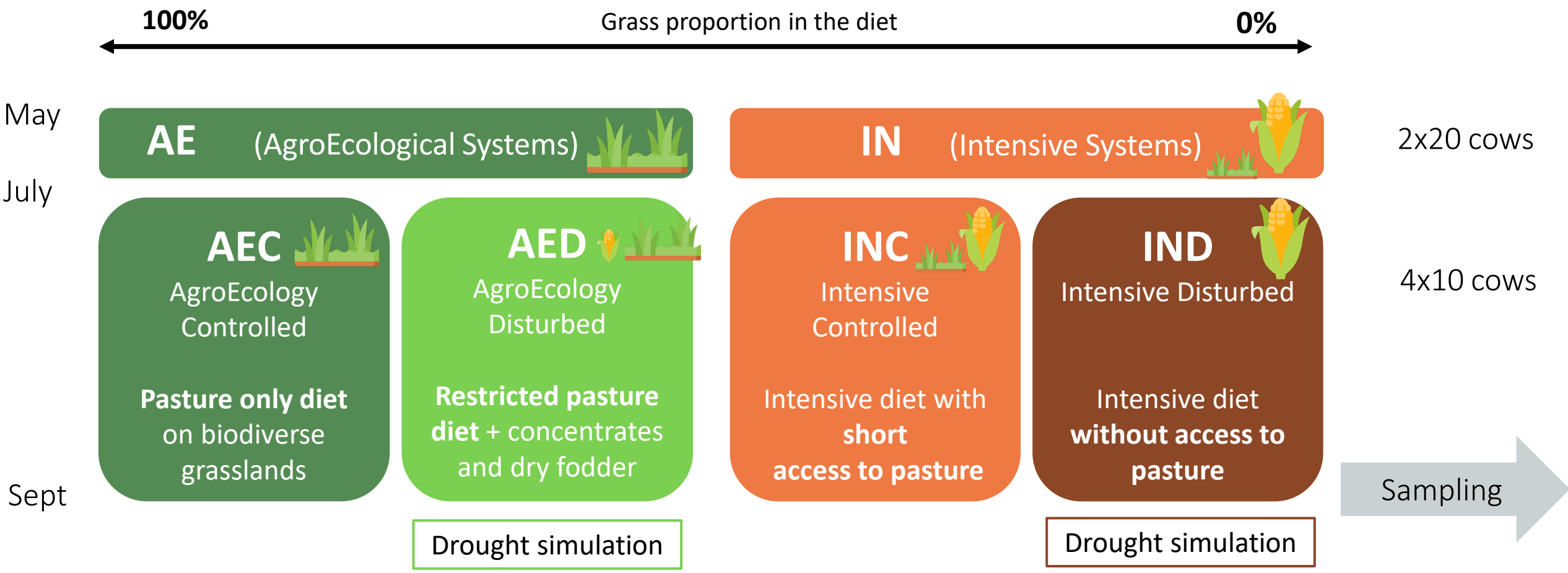
B vitamins content variations : *the questions*



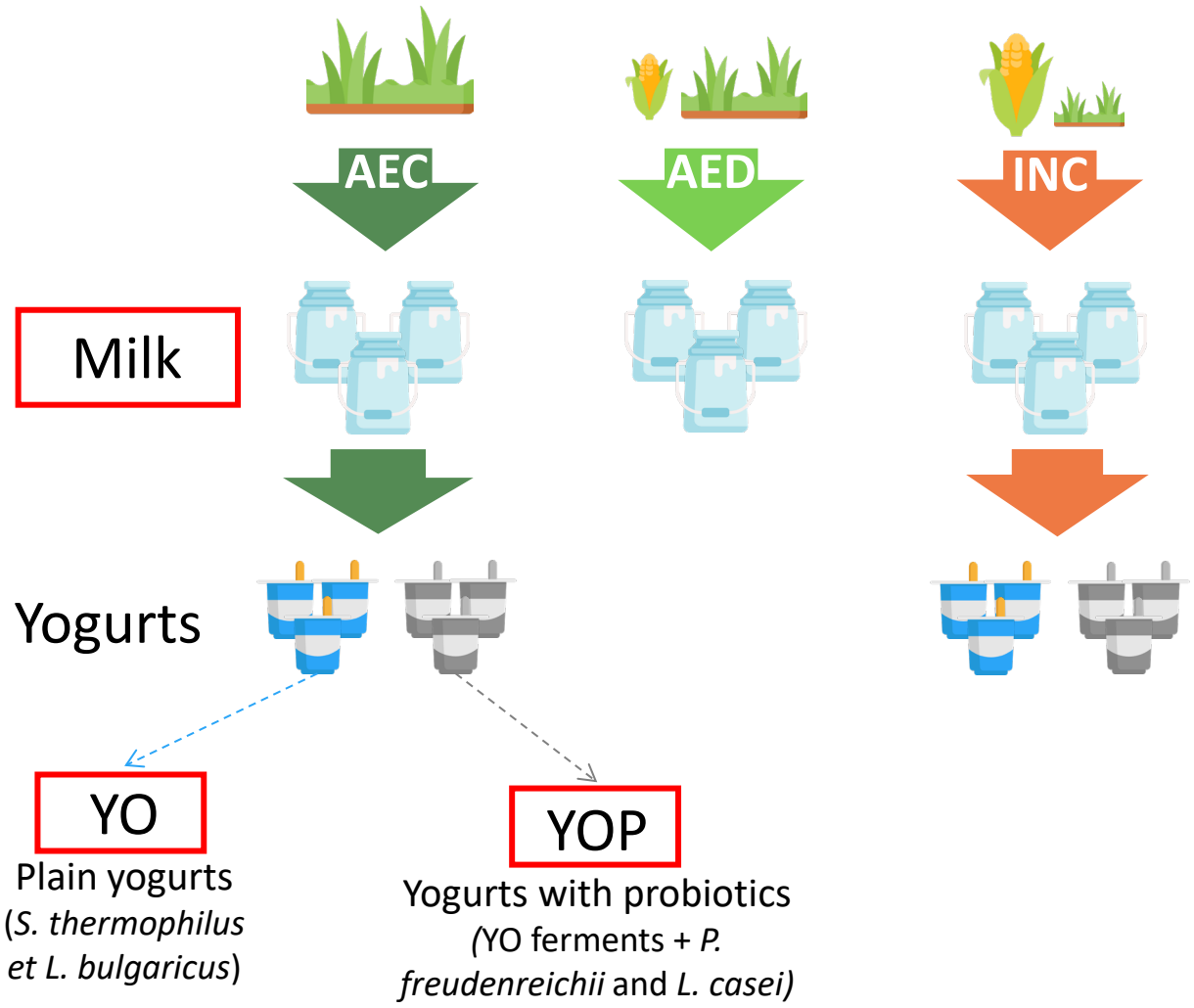
- Does the diet composition of dairy cows can modulate the composition in B vitamins of raw milk ?
- Does the modification observed in raw milk can be seen in the corresponding yogurts ?
- Is it possible to modulate the content of B vitamins with the add of probiotics in yogurt ?

Experimental design

MAT & MED



Experimental design



Analysis of B vitamin concentration

Vitamins	Methods
B1 – B5	UPLC MS *(Auzance et al., 2024, not published)*
B2 – B6	UPLC FLR *(Laverroux et al., 2020)*
B9 – B12	Chimoluminescence assay kit *(adapted from Duplessis et al., 2015)*

Linear model of 2-way Anova & Tuckey test :

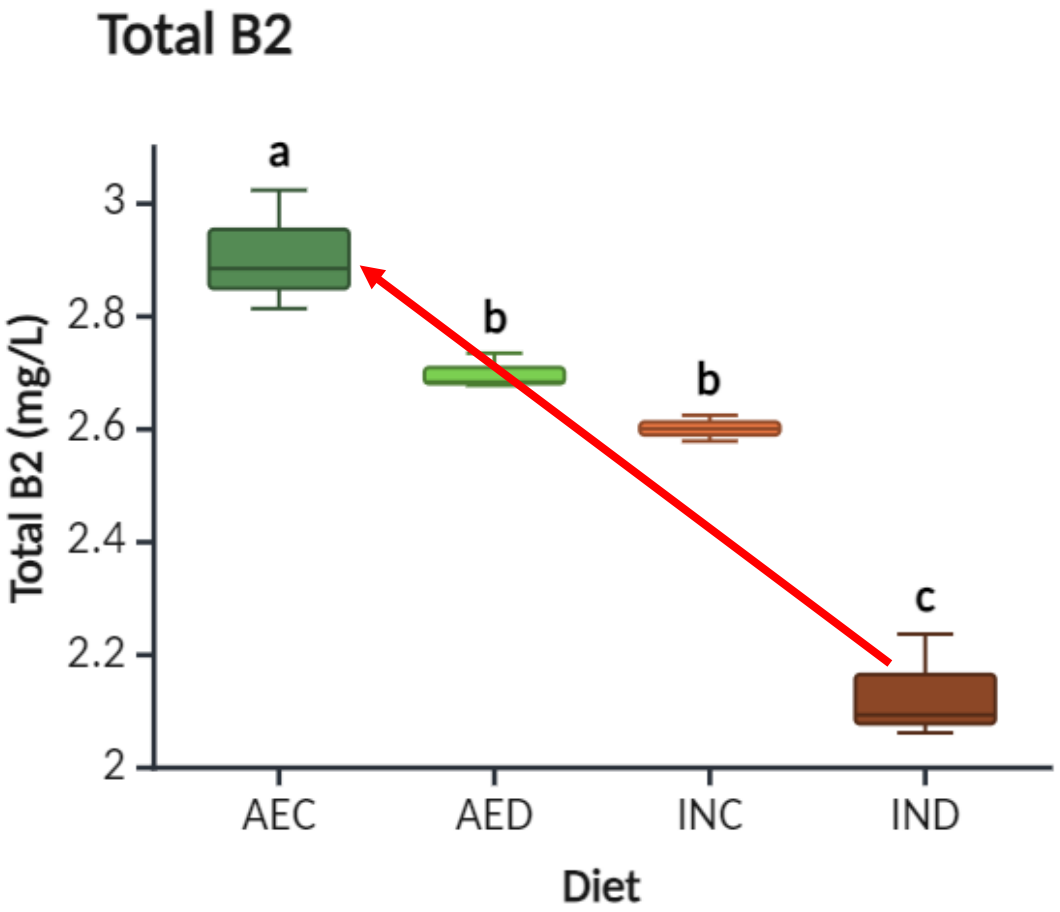
System * Disturbance OR Dairy pdt * System

AE vs IN * (AEC+INC) vs (AED+IND)

YO vs YOP * AE vs IN

Milk : *the more grass, the more B2*

P value **System x Disturbance** < 0.05



Grazing-based production systems

+36.7% of B2

AEC ← *+100% grass 0%* — IND

+22% of B2

INC ← *+2h access to pasture* — IND

Milk : *the more grass, the more B2*

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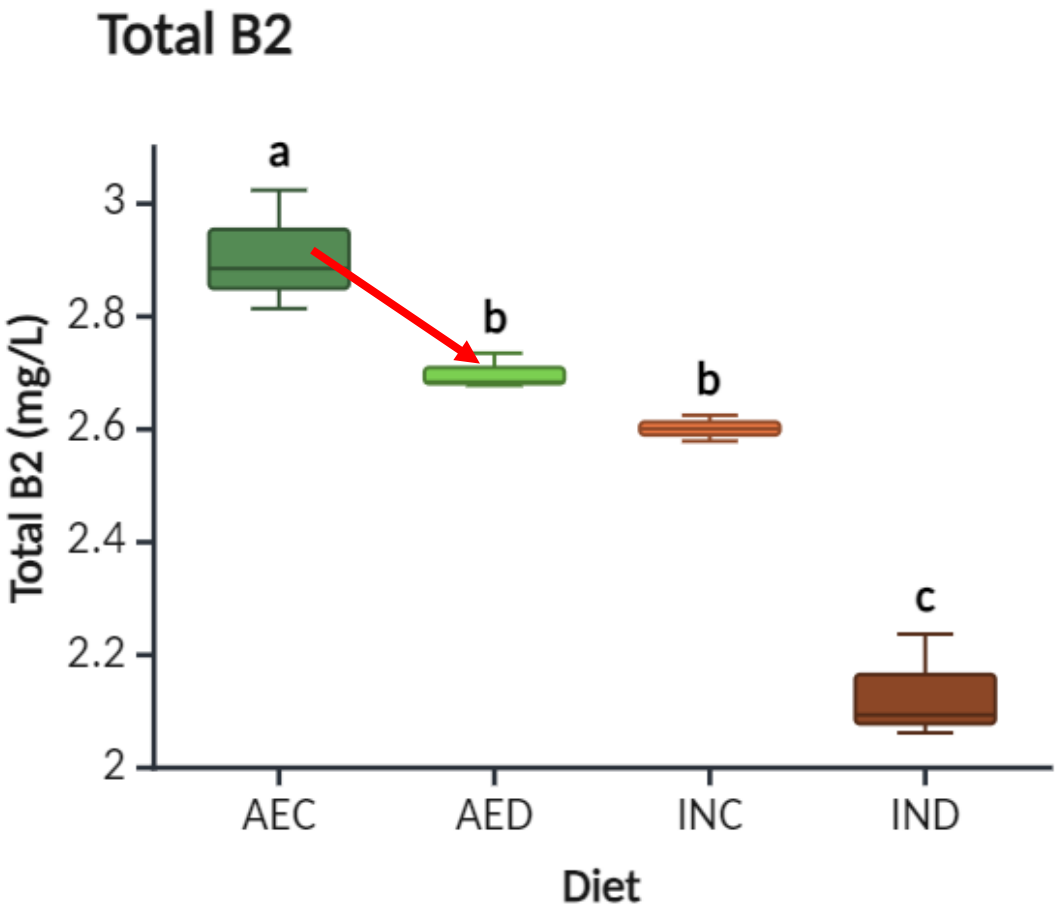


Grazing-based production systems

+36.7% of B2

AEC ← *+100% grass 0%* — IND

+22% of B2

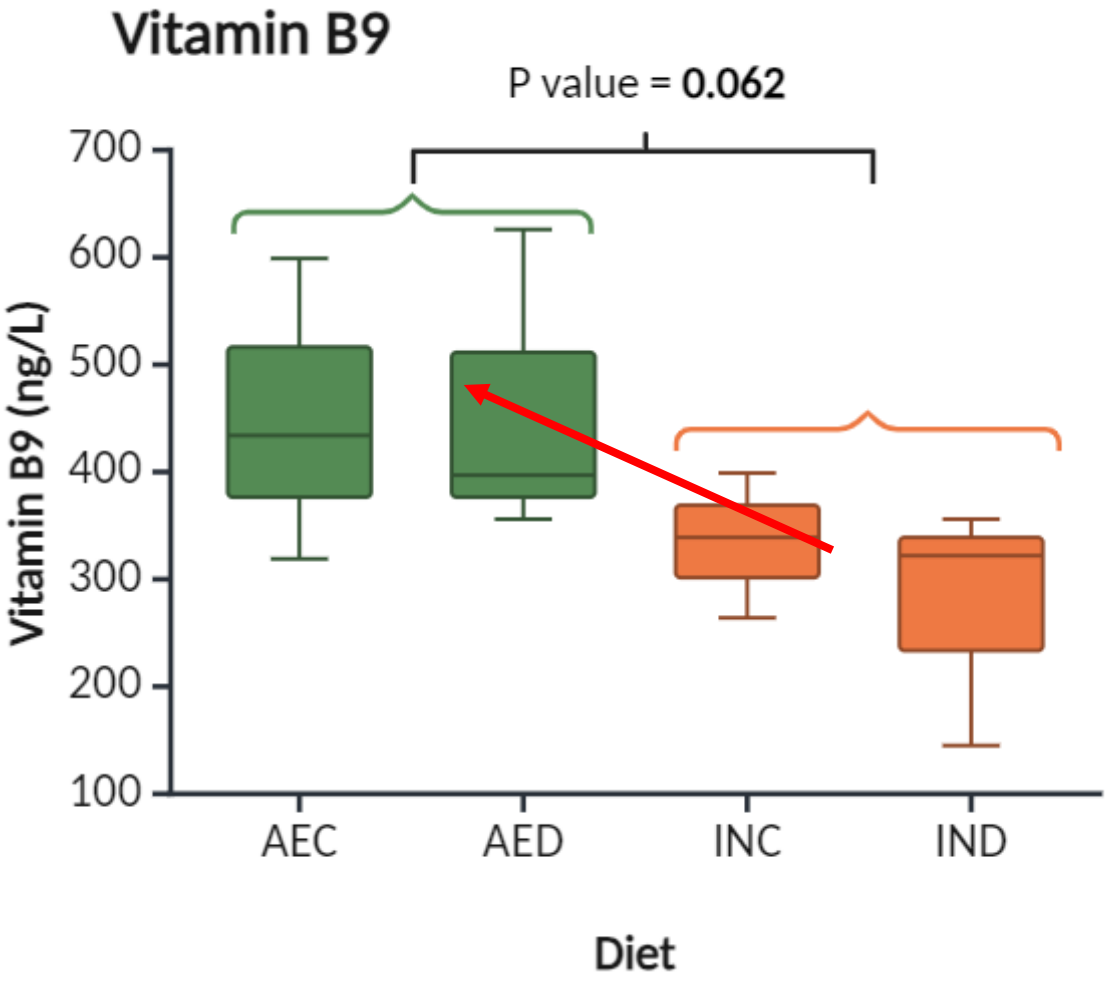
INC ← *+2h access to pasture* — IND

Drought limiting grazing

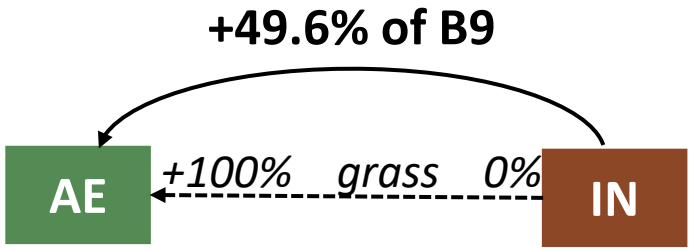
-7.7% of B2

AEC → *Less grass* → AED

Milk : *increase of B9 with extensive system*

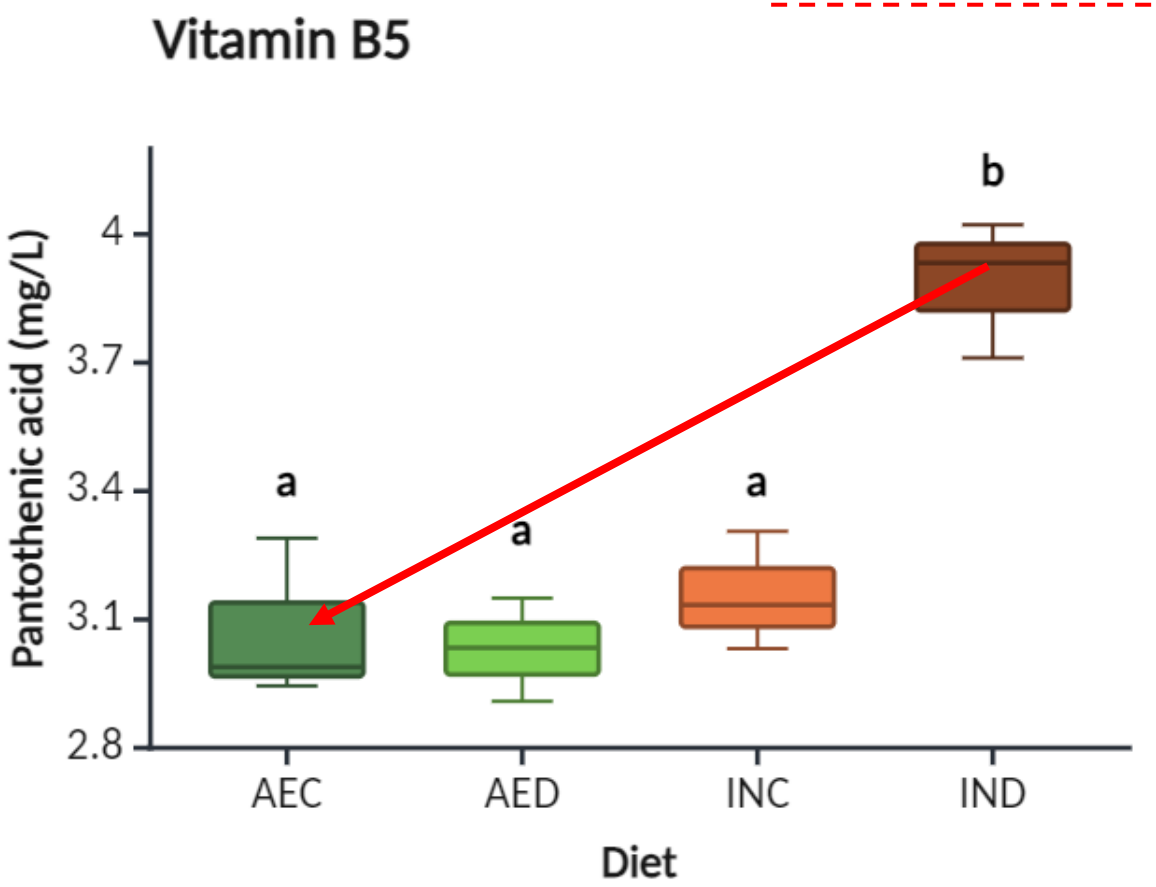


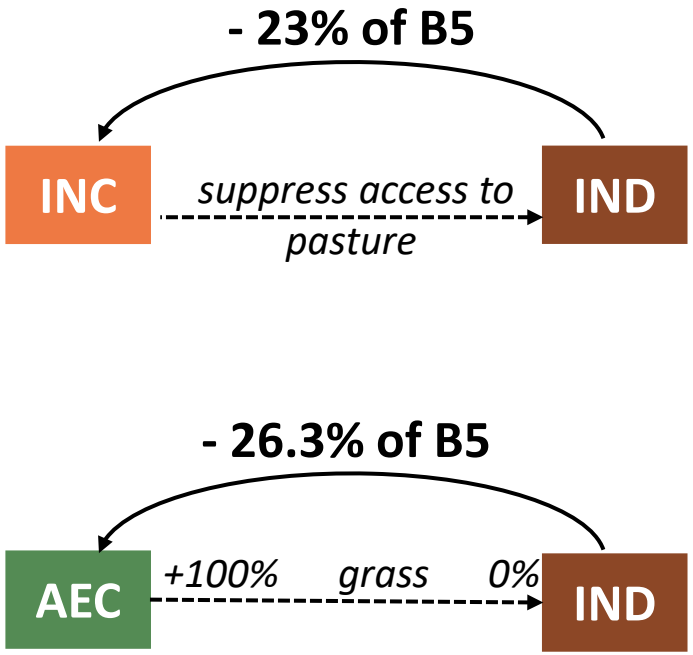
0.05 < P value **System** < 0.1



Milk : *No access to pasture, increase B5*

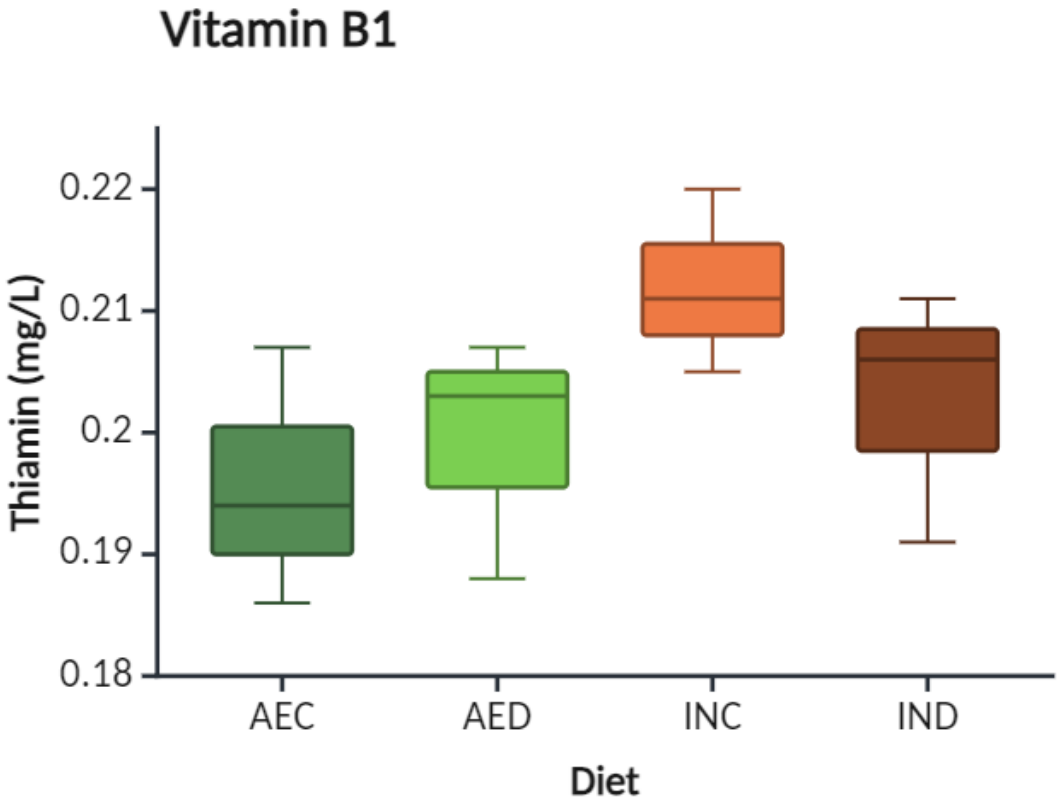
P value **System x Disturbance** < 0.05

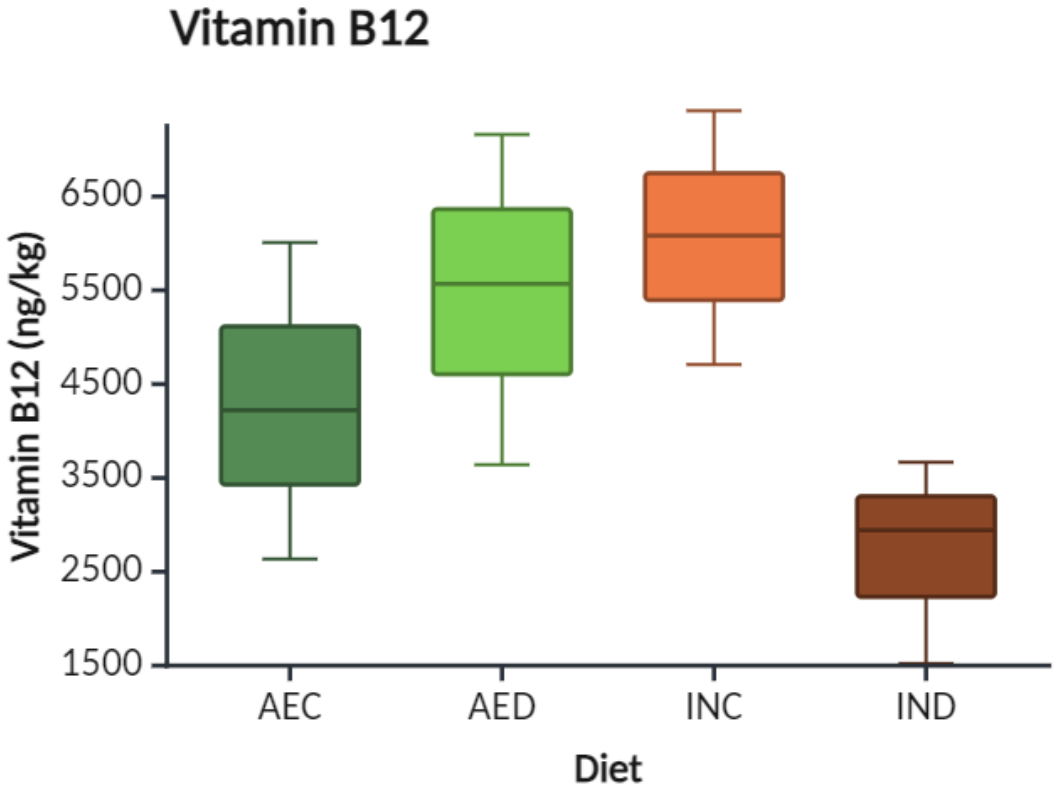




Milk : *optimum for B1 and B12 with INC*

Same samples ≠ analysis methods





P value **System * Disturbance** < 0.05

Milk : the concentration of B vitamins does vary

DISCUSSION

Does the diet composition of dairy cows can modulate the composition in B vitamins of raw milk ?

B2 : Confirm the previous results *(Laverroux et al., 2014)*

B9 : Seems to follow a pattern already observed *(Chassaing et al., 2011)*

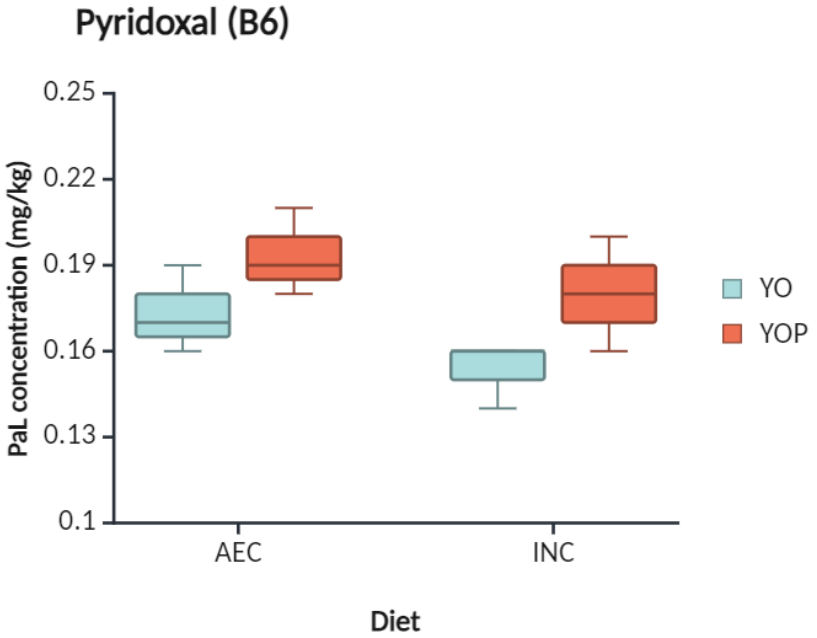
B5 : Complete the previous results on forage proportion increase *(Ragaller et al., 2011)*

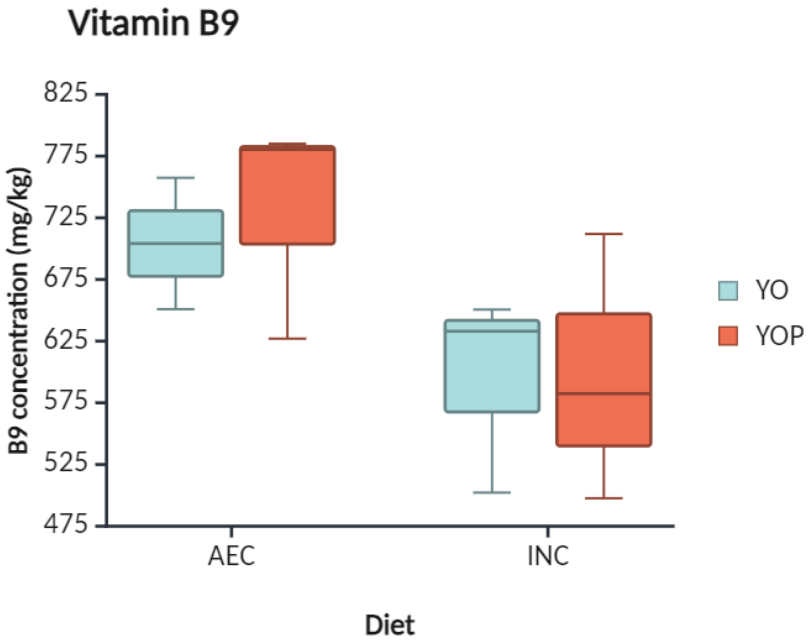
B12 : Similar to what observed by *Chassaing et al., (2011)*; but not in every study *(Duplessis et al., 2019)*

B1 : Pattern never observed before

Can these results be transferred to yoghurt ?

Yogurts : *the more grass, the more B6 & B9 (trends)*



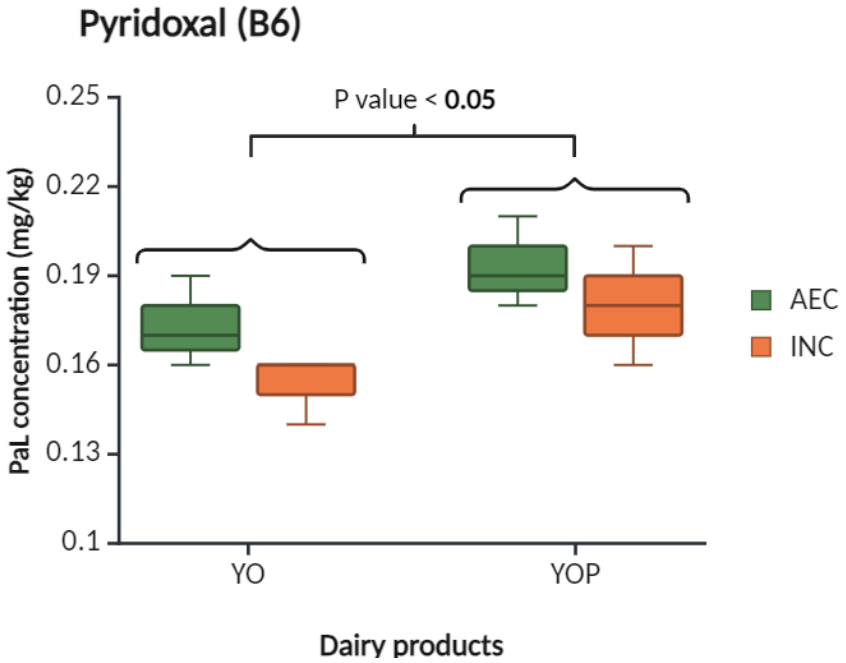


0.05 < P value **Diet** < 0.1

Does the modification observed in raw milk can be seen in the corresponding yogurts ?

- The effects of diet visible in milk are not translated into yoghurts → interaction and loss during process
- Matrix different from milk, so impact of ferment synthesis *(Walthers et al., 2017, Leblanc, et al., 2015)*

Yogurts : *probiotics increase vitamin B6*



Effect of probiotics only on pyridoxal (B6)

P value **Dairy product** < 0.05

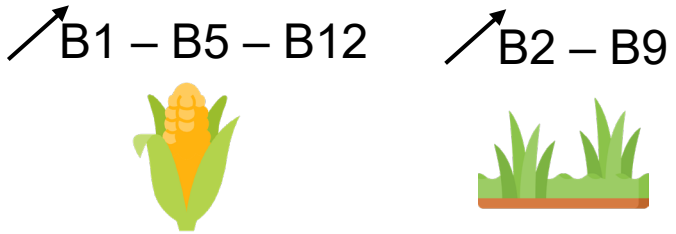
Is it possible to modulate the content of B vitamins with the add of probiotics in yogurt ?

- De novo synthesis of B6 seems possible with this couple of probiotics (*P. freudenreichii* and *L. casei)*
- Synthesis of B2 has been demonstrated with other probiotics *(Leblanc et al., 2006)*

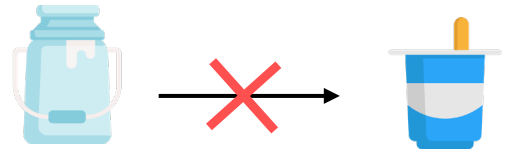
Take home messages

CONCLUSION

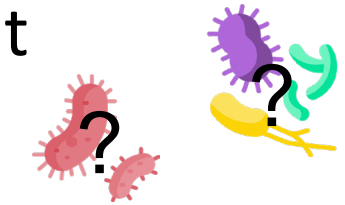
- Not ONE best milk but SEVERAL type of milk



- Modulation seen in milk does not transfer in yogurts



- Synthesis of B vitamins with probiotics seems possible with different couple of probiotics



Thank you !

SUPERVISION & PARTNERSHIPS

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Sophie Laverroux

Syalsa consortium

Tandem consortium

Dr. Jennifer Ronholm

Alla Yushencko

Ronholm lab

Dr. Mélissa Duplessis

Véronique Roy

FUNDINGS

Metaprograms Syalsa & Holoflux

WOW ! program

Future steps

- Design at the individual level :

→ Exploring the importance of ruminal microbiota synthesis on B vitamins status of dairy cows

→ Article in preparation

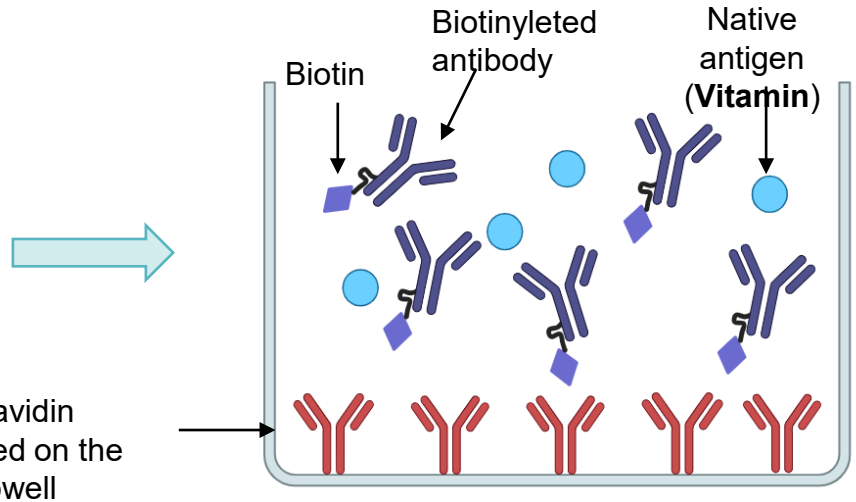
Collaboration with McGill MACDONALD CAMPUS

- We already observe signification for some no and for some pattern we don't understand so it could be interesting to demonstrate that on a larger scale experiement

Chimoluminescence principle

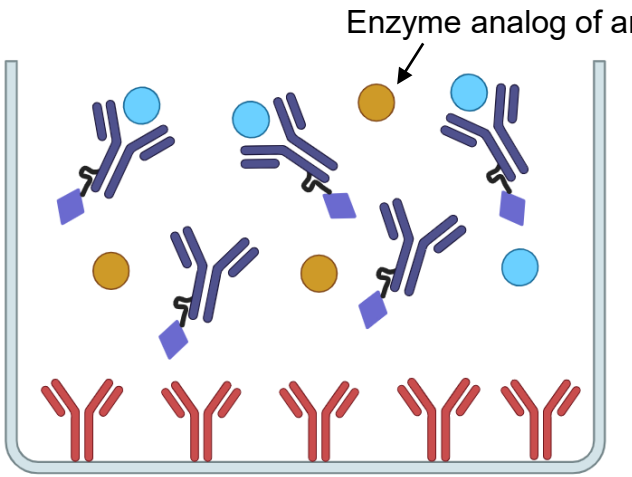
SUPP MATERIALS

Extraction of vitamins B9 or B12 from milk / cheese / yoghurt

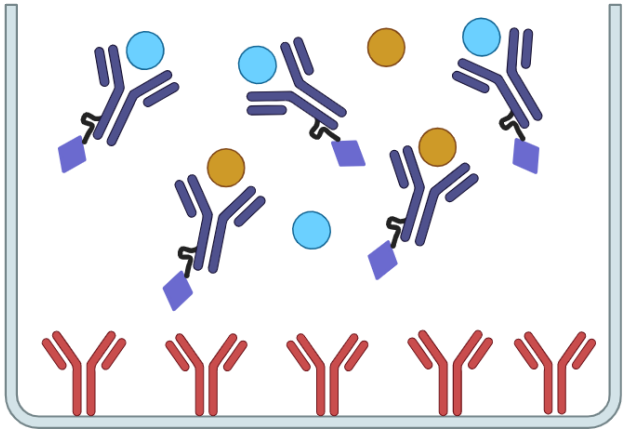


INCUBATION :

Formation of immune complexes

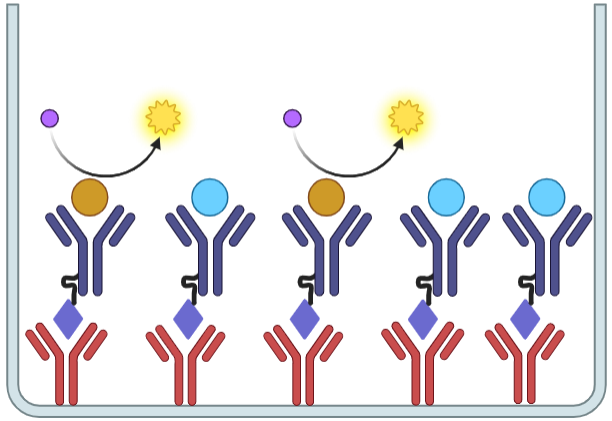


INCUBATION :
Competition for binding sites



WASH & REAGENT ADD :

Binding of biotin to streptavidin



CHIMOLUMINESCENCE Reading:
RLU (Relative Light Unit) reading Inversely proportional to native antigen concentration

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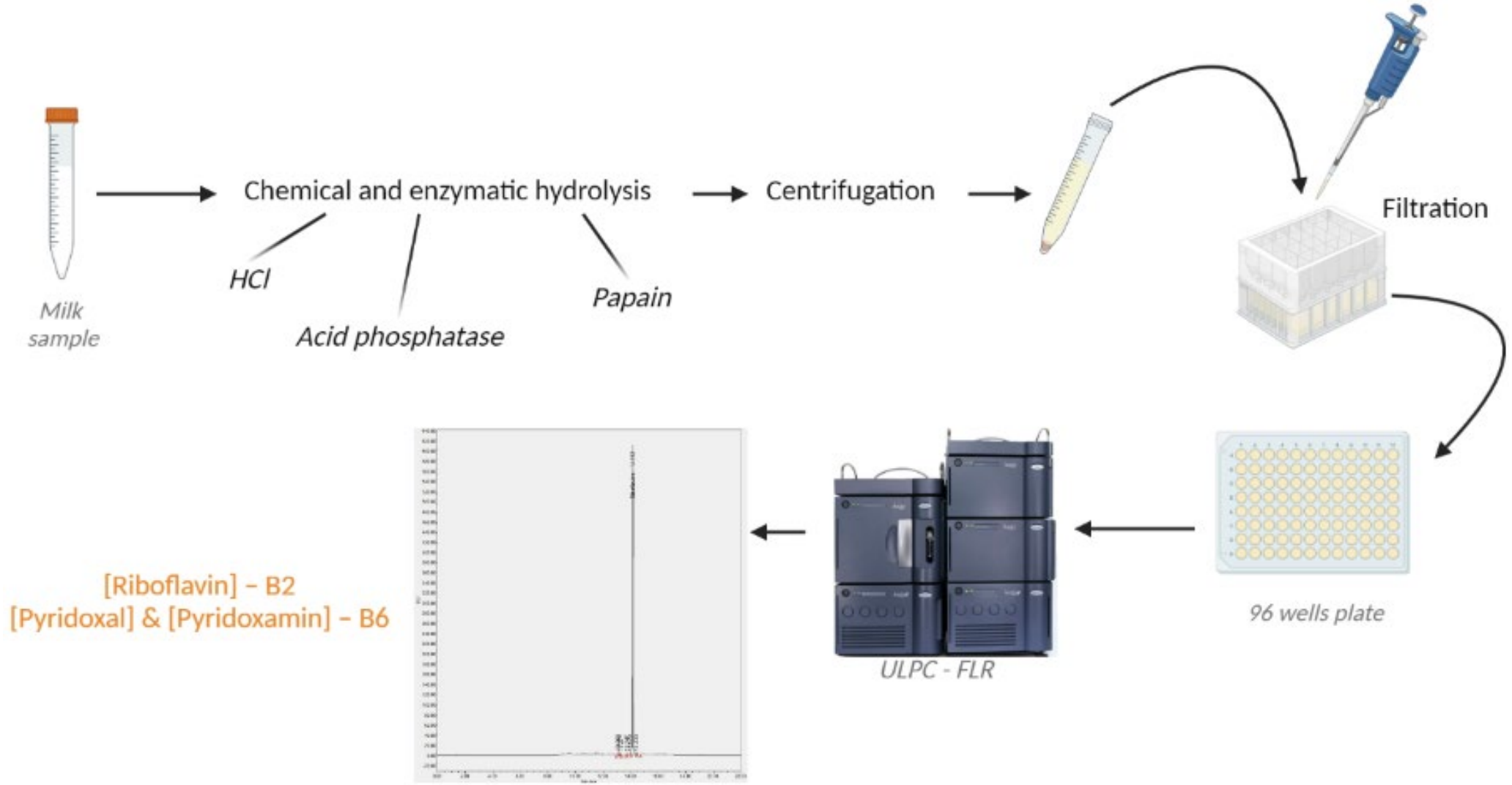
Agriculture and Agri-Food Canada

B2 and B6 in milk

SUPP MATERIALS



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