Mammary gland modulation on metabolic and immune status of dairy goats and their offspring

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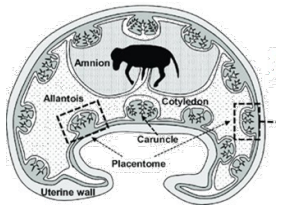
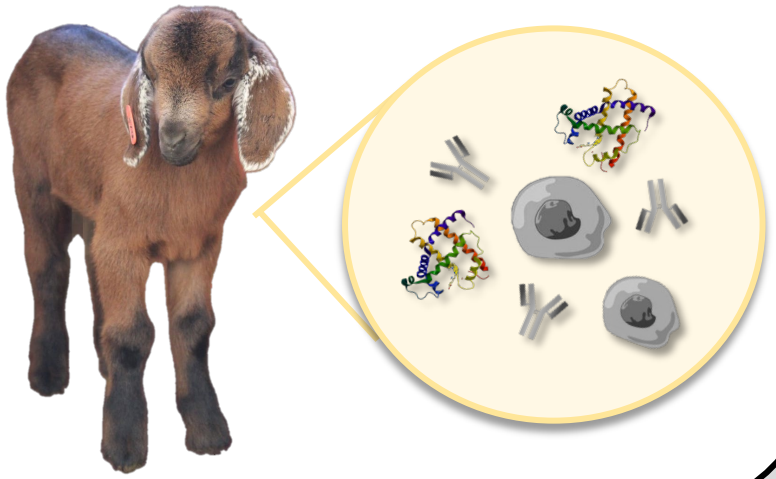
Background

Passive Immune Transfer

Synepitheliochorial placenta

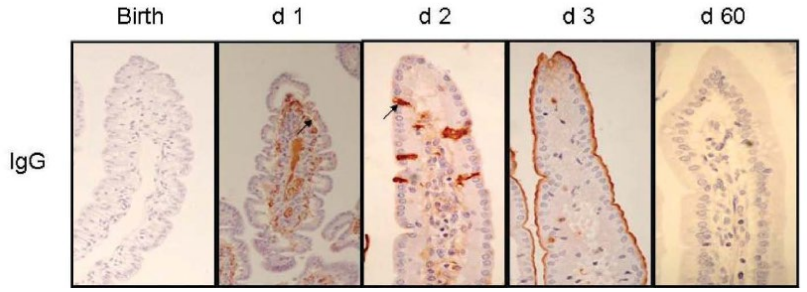


Carlson et al. (2021)



Intestinal absorption

Timing



Castro-Alonso et al. (2008)

Quality

Table 3. Immunoglobulin G (least squares means) blood serum in kids fed high, medium, and low concentrations[1] of IgG from lyophilized paste.

Time	H-IgG	M-IgG	L-IgG	SEM	*P*
0	0	0	0	0	0.001
12	9.02[a]	4.03[b]	1.55[b]	0.36	
24	9.53[b]	4.69[b]	3.26[b]	0.36	
36	10.28[a]	5.63[b]	4.54[b]	0.51	
48	8.85[a]	4.42[b]	3.65[b]	0.34	
60	8.43[a]	3.99[b]	2.81[b]	0.27	
72	8.14[a]	3.63[b]	2.39[b]	0.23	
84	7.50[a]	3.24[b]	2.02[b]	0.27	
96	7.23[a]	3.26[b]	2.34[b]	0.27	
108	6.79[a]	3.42[b]	2.26[b]	0.24	

Castro et al. (2005)

Background

- High variability in goat colostrum quality

International Journal of Dairy Technology SDT SOCIETY OF DAIRY TECHNOLOGY

doi: 10.1111/1471-0307.12163

ORIGINAL RESEARCH

Effect of postpartum time and season on the physicochemical characteristics of Murciano-Granadina goat colostrum

Journal of Dairy Research (2016) **83** 366–374. © *Proprietors of Journal of Dairy Research 2016* 366
doi:10.1017/S0022029916000273

A proteomics study of colostrum and milk from the two major small ruminant dairy breeds from the Canary Islands: a bovine milk comparison perspective

J. Dairy Sci. 102:5542–5549
https://doi.org/10.3168/jds.2018-16235

Immunoglobulin G content and colostrum composition of different goat and sheep breeds in Switzerland and Germany

Breed	Min IgG, mg/mL	Max IgG, mg/mL
Majorera (Spain)	27.51	54.75
Camosciata (Italy)	34.21	106.38
Saanen (Switzerland)	1.31	16.53
Toggenburg (Switzerland)	2.33	12.56
Murciano-Granadina (Spain)	27.11	41.45

animals MDPI

Article

Colostrum Quality in Different Goat Breeds Reared in Northern Italy

Background

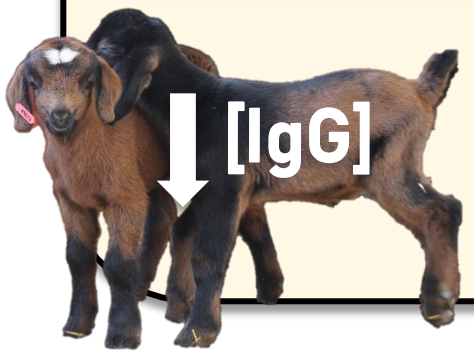
Failure of Passive Immune Transfer

Neonatal mortality

IgG (mg/ml) serum concentrations in dead and alive kids

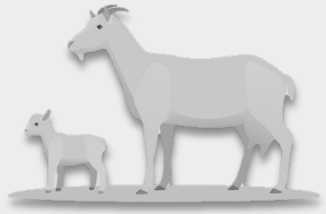
Time (h)	Alive	Dead	Viability effect ($P<$)
0	0	0	0.018
12	8.60 ± 10.36	0.47 ± 1.24	
24	15.18 ± 13.22	5.19 ± 11.20	
36	16.09 ± 17.09	6.04 ± 11.52	
48	15.92 ± 13.46	4.85 ± 9.03	
60	14.98 ± 13.03	7.15 ± 11.90	
72	11.55 ± 8.11	7.73 ± 12.35	
84	15.33 ± 11.70	8.78 ± 11.98	

Results in mean ± standard deviation.

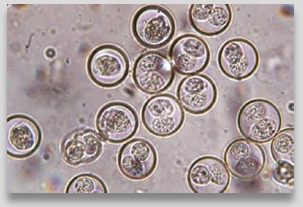


Argüello et al. (2004)

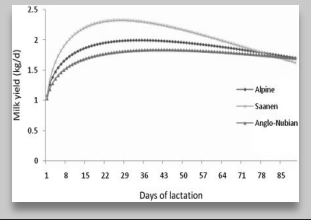
Average daily gain



Disease susceptibility

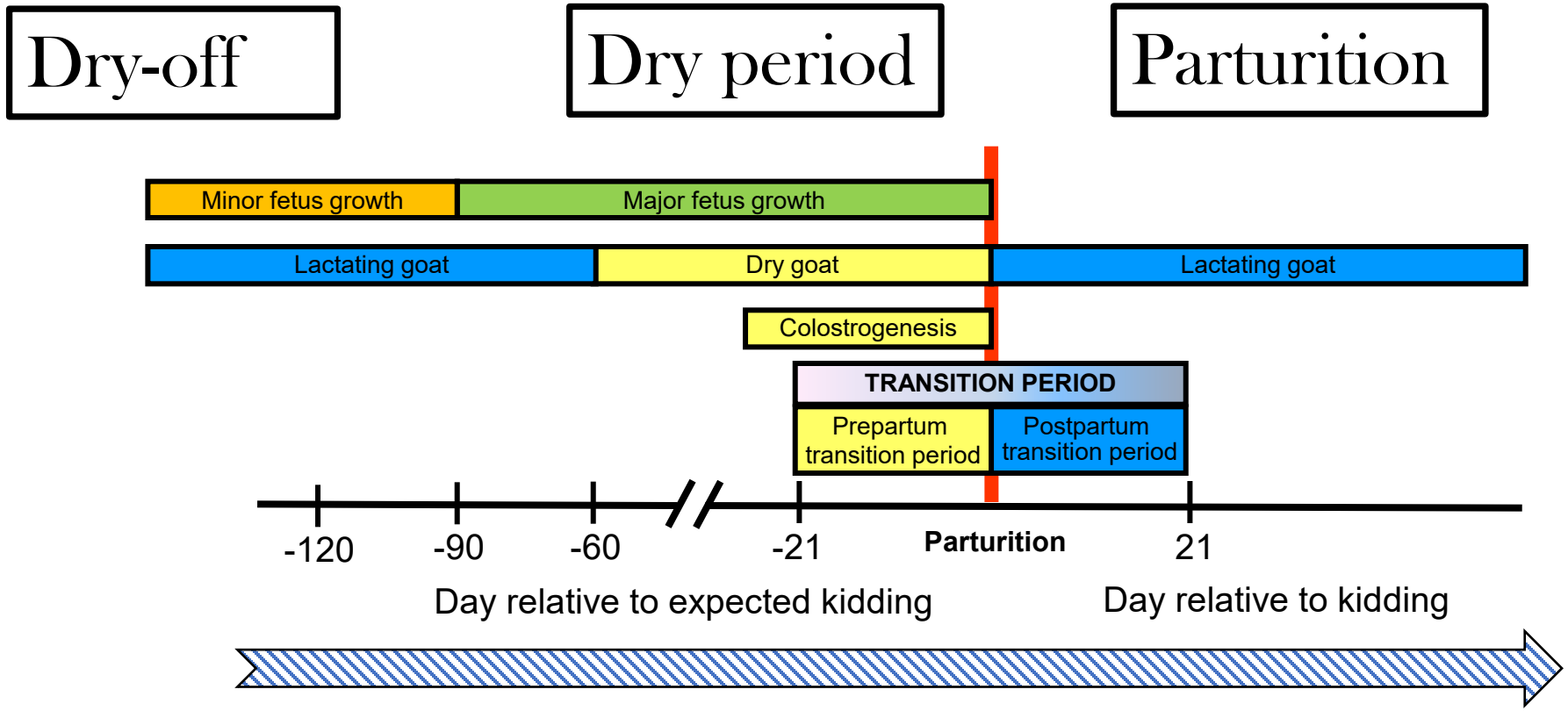


Milk production

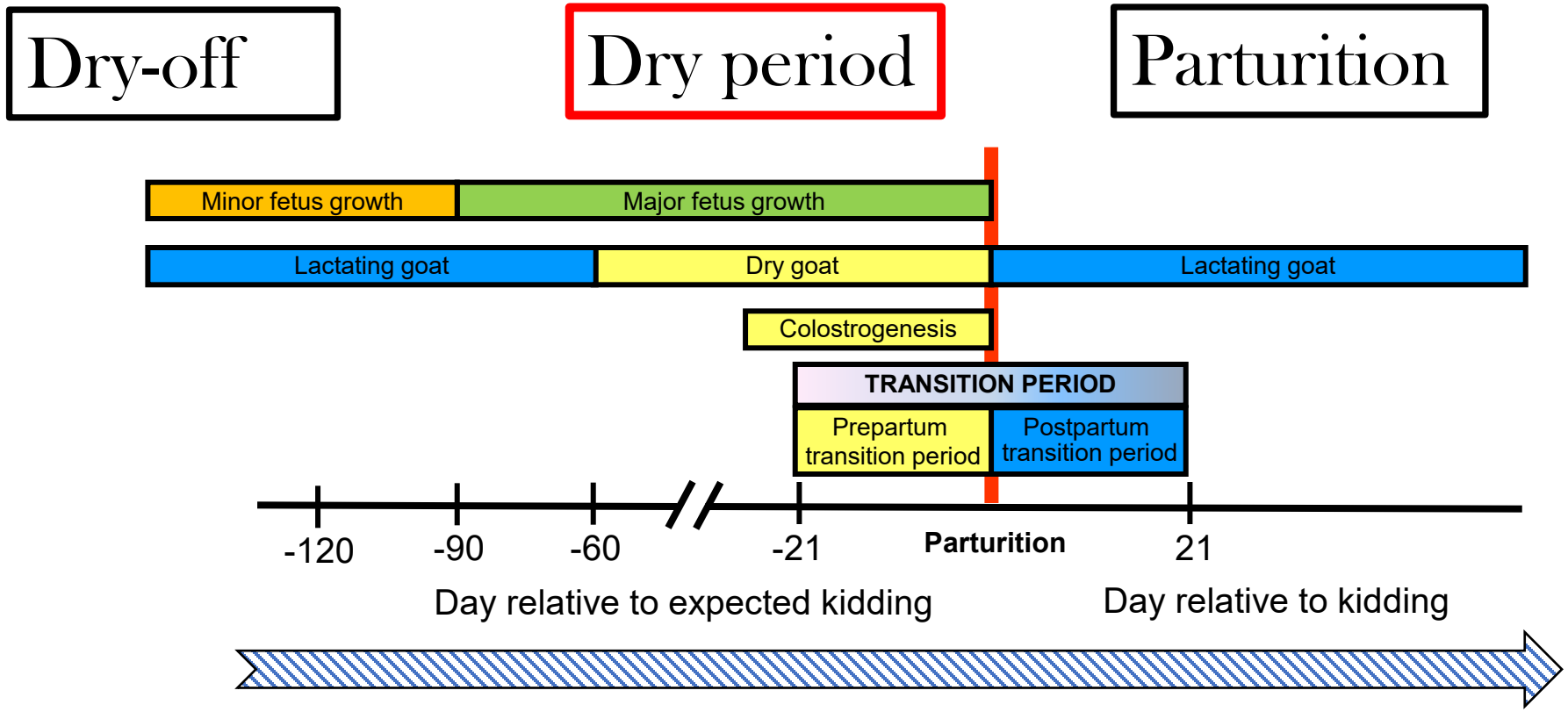


Weaver et al. (2000)

How can we enhance colostrum quality in dairy goats?



How can we enhance colostrum quality in dairy goats?



How can we enhance colostrum quality in dairy goats?

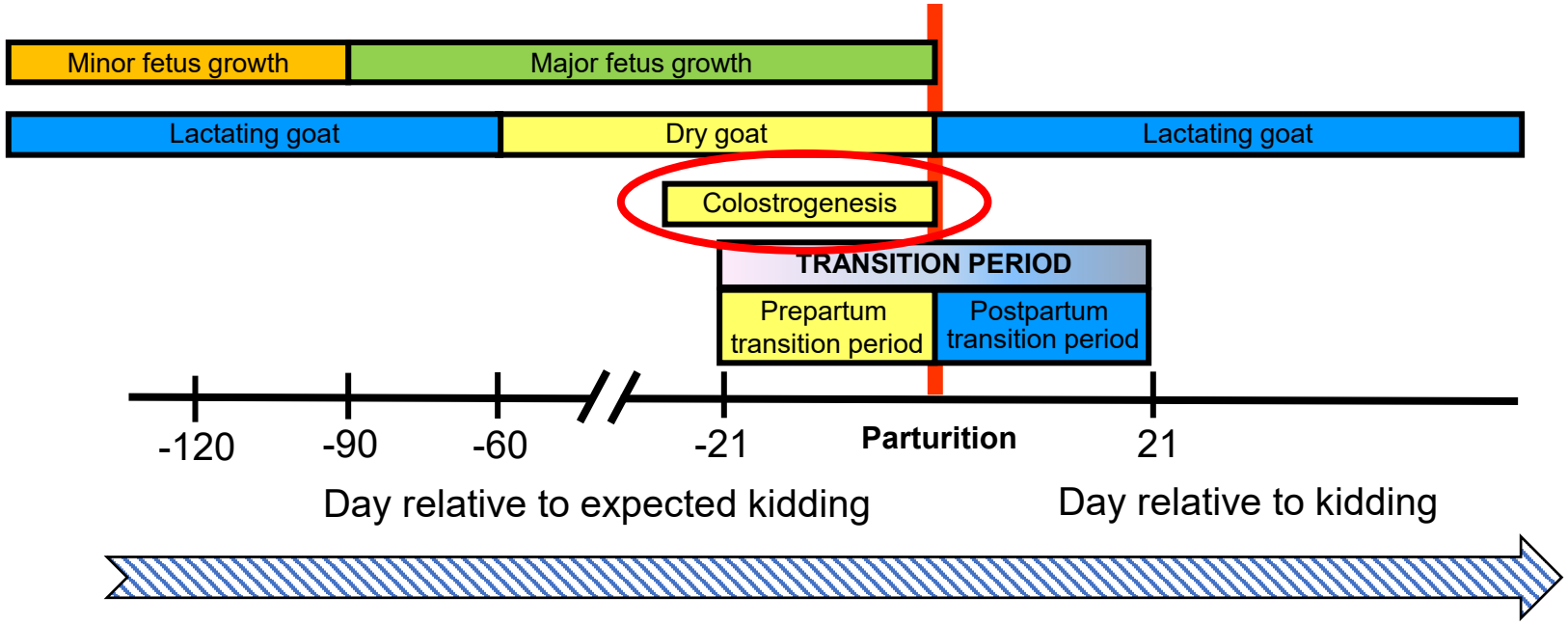
Using a prepartum high-starch diet to enhance colostrum quality and improve passive immune transfer in dairy goats

Background

- Colostrum quality affected by prepartum diet?

Richards et al. (2009)
Vasquez et al. (2011)
Litherland et al. (2011)

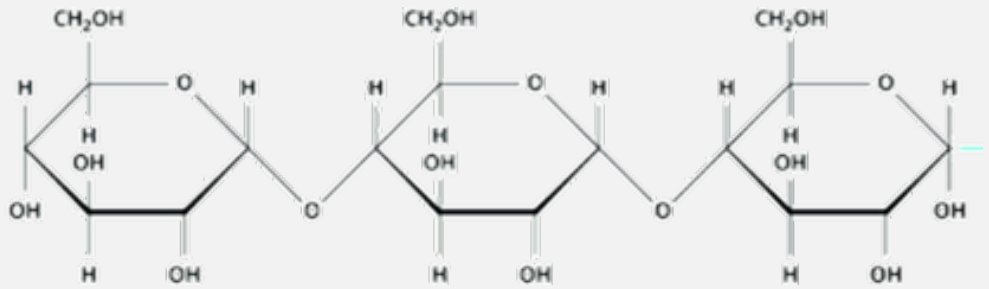
Mann et al. (2016)
Meier (2015)



Background

- Colostrum quality affected by prepartum diet?

High-Starch diet



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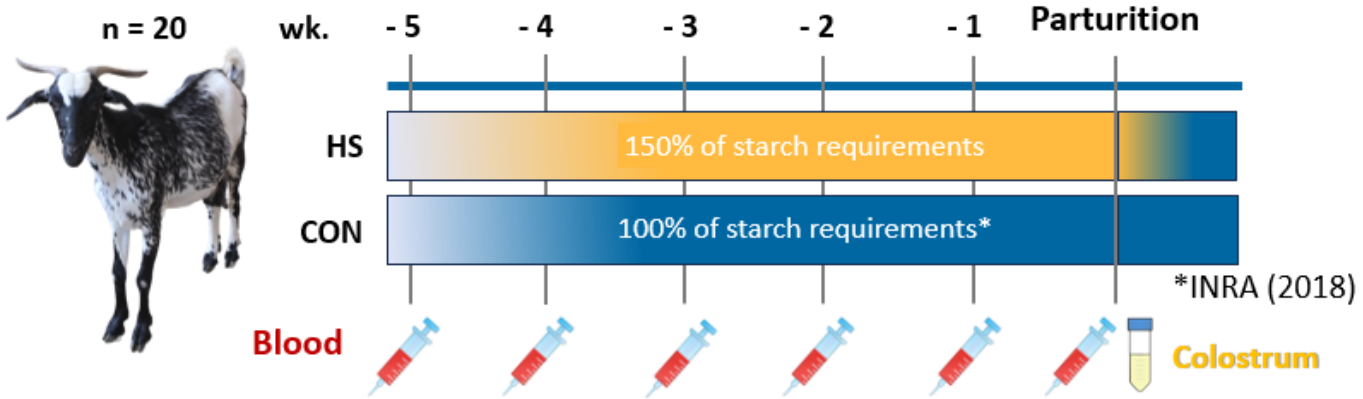
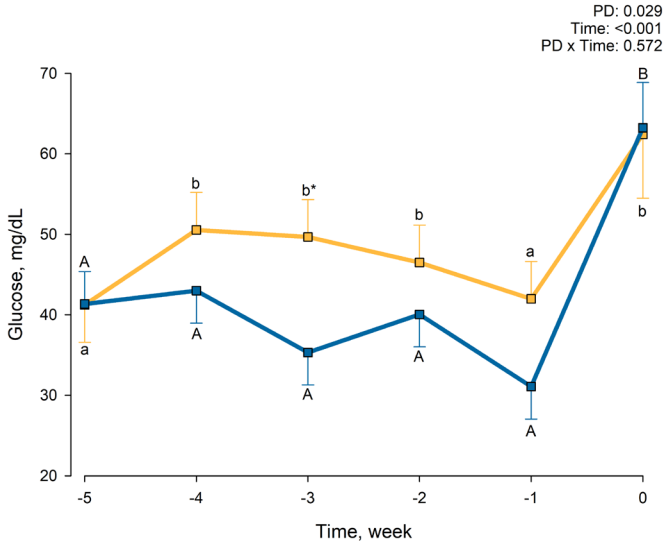
Experimental design

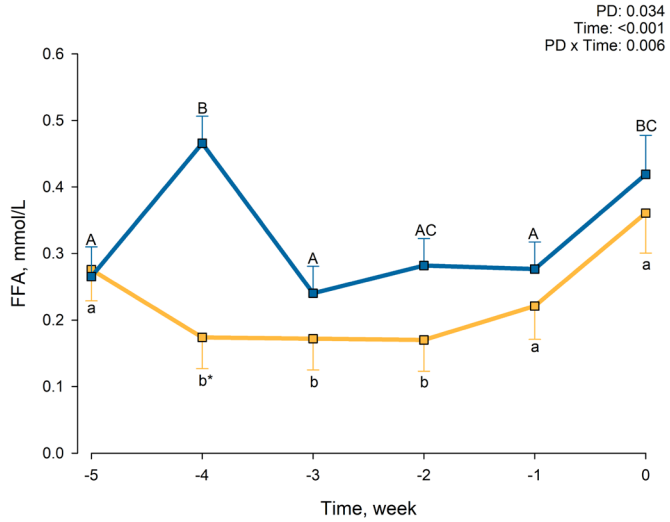


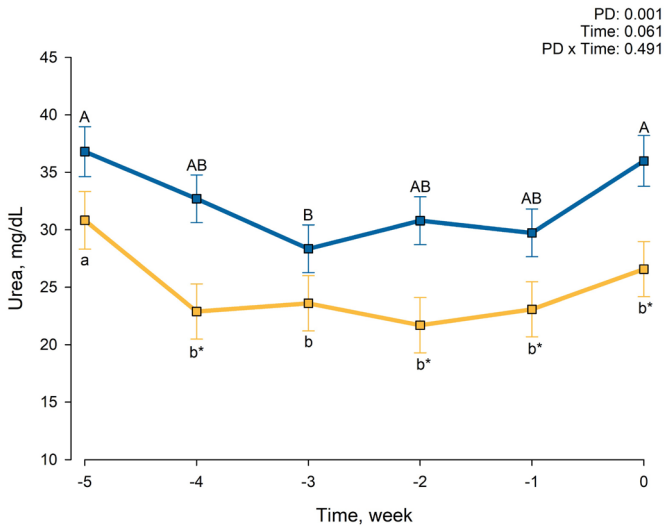
Animal experiment procedure: OEBA-ULPGC 03/2023

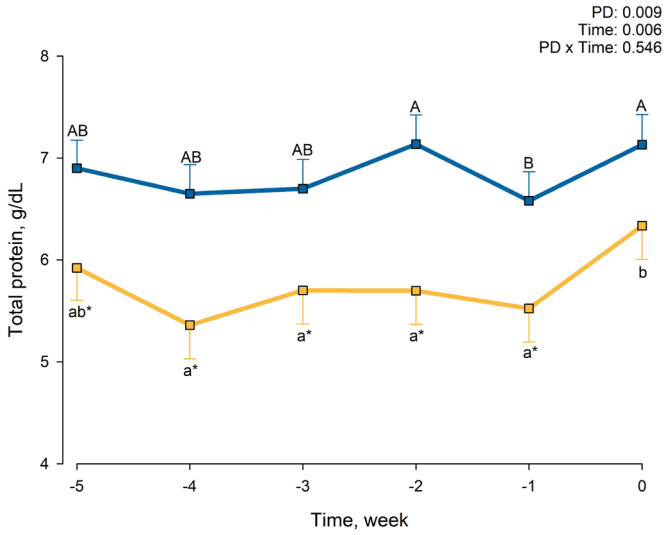
Animal experiment procedure: OEBA-ULPGC 04/2023

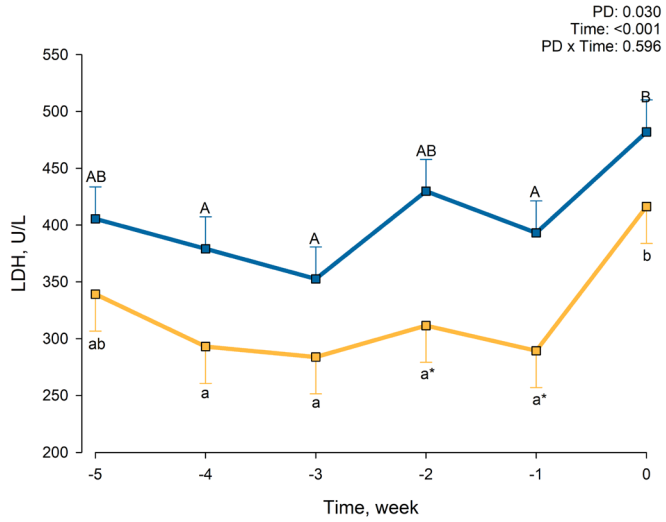
Main findings (goats/blood)











Main findings (goats/blood)

Prepartum high-starch diet

Glucose ↑

Free fatty acids ↓

Prepartum high-starch diet → Reduced fat mobilisation and muscle catabolism

Main findings (goats/colostrum)

	Groups			Fixed effect, p-value
Variables	HS	CON	SEM	Prepartum diet
Yield, kg	1.9	1.7	0.44	0.830
SCC, log10	3.0	2.8	0.20	0.351
BRIX, °	24.2	21.0	1.48	0.137
Fat, %	6.4	6.4	0.70	0.955
Lactose, %	3.4	3.2	0.26	0.607
Protein, %	10.0	12.1	1.20	0.196
Total solids, %	22.4	24.7	1.34	0.207

Energy supplementation in goats and ewes

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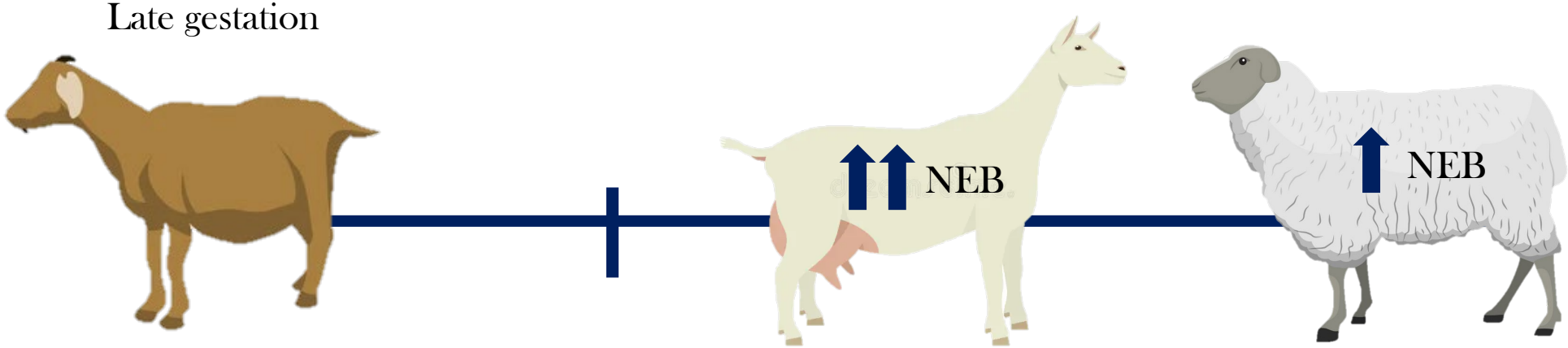
↑ [Glucose] Wang et al. 2016

↓ [FFA] Cannas et al. 2004

Late gestation

Lactation



No literature

Energy supplementation during lactation did not change the metabolic and hormonal profile in goats and ewes
Lunesu et al. (2021)

Conclusions

High-starch prepartum diet

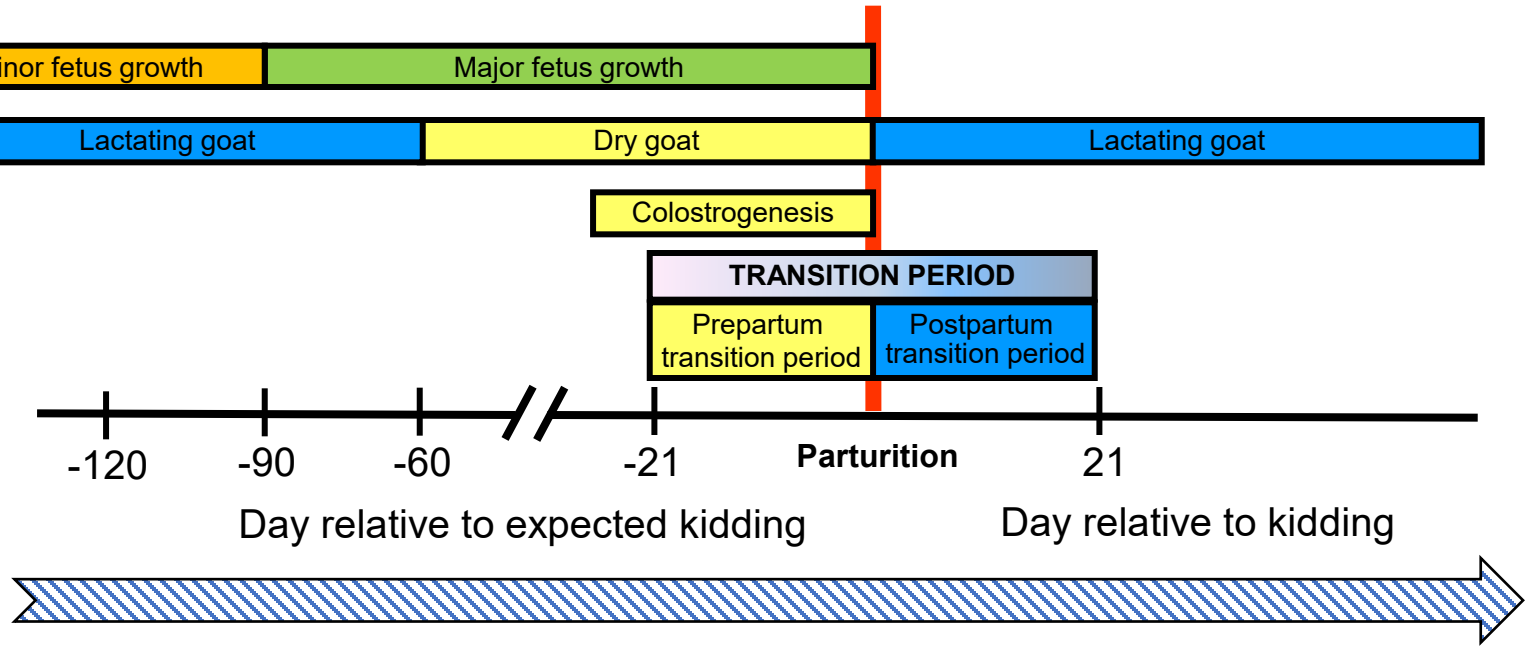
- Does not affect either colostrum yield or composition.
- Promote a smoother transition from late pregnancy to early lactation by increasing serum glucose concentration and reducing fat mobilization.

How can we enhance colostrum quality in dairy goats?

Dry-off

Dry period

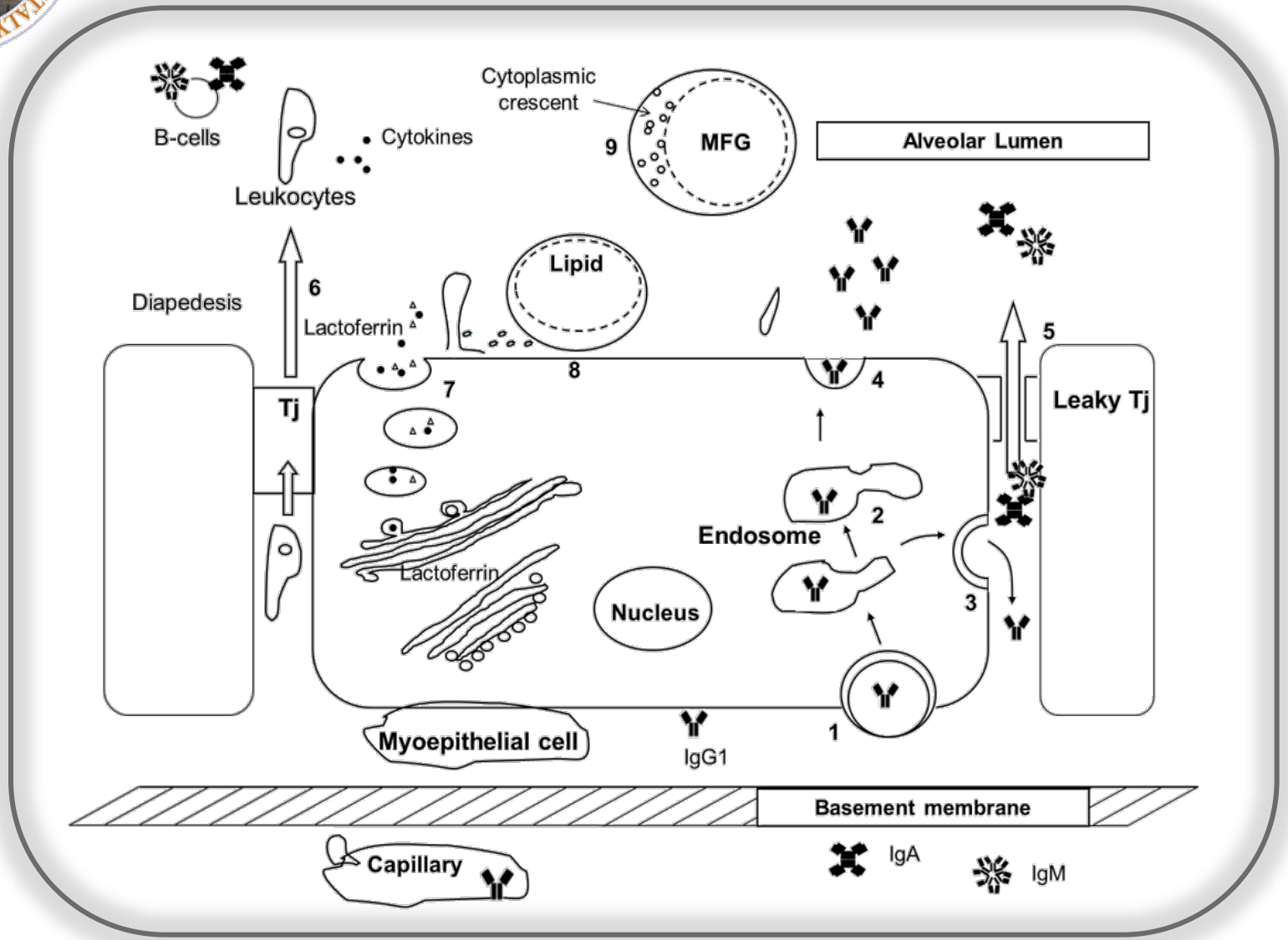
Parturition



How can we enhance colostrum quality in dairy goats?

Using intramammary lipopolysaccharides to enhance colostrum quality and improve passive immune transfer in dairy goats

Background



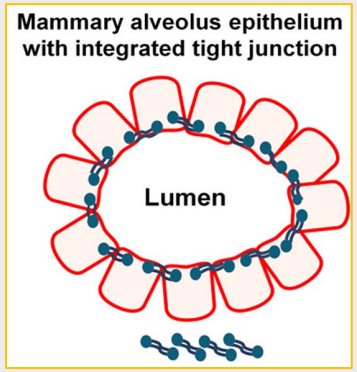
Baumrucker & Bruckmaier (2014)

Hernández-Castellano et al. (2018)

Baumrucker et al. (2022)

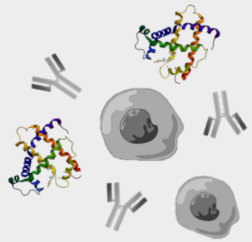
Background

Blood-milk barrier



Zhang et al. 2015

Colostrogenesis



Background

Mastitis

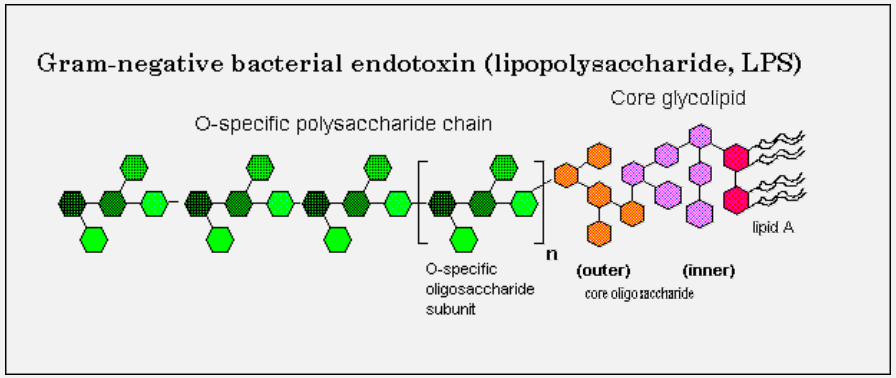
Integrity

Permeability

Different chronological patterns of appearance of blood derived milk components during mastitis indicate different mechanisms of transfer from blood into milk.
Wellnitz et al. (2015)

Pathogen-specific immune response and changes in the blood–milk barrier of the bovine mammary gland.
R. Bruckmaier and O. Wellnitz (2017)

Lipopolysaccharides



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Intramammary administration of lipopolysaccharides at parturition enhances immunoglobulin concentration in goat colostrum

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J. Dairy Sci. TBC:1–9
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Intramammary administration of lipopolysaccharides at parturition does not affect the transfer of passive immunity in goat kids

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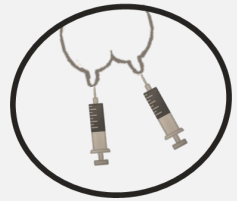
Experimental design

Animal experiment procedure: -OEBA-ULPGC 27/2021

Animal experiment procedure: -OEBA-ULPGC 28/2021

Experimental groups



LPS

50 µg de LPS in 2 mL saline solution 0.9%

n = 19

CONTROL

2 mL of saline solution 0.9%

n = 26

Gestation length was 150 ± 2 days; Litter size 2.1 ± 0.56

Main findings (goats)

- Systemic response

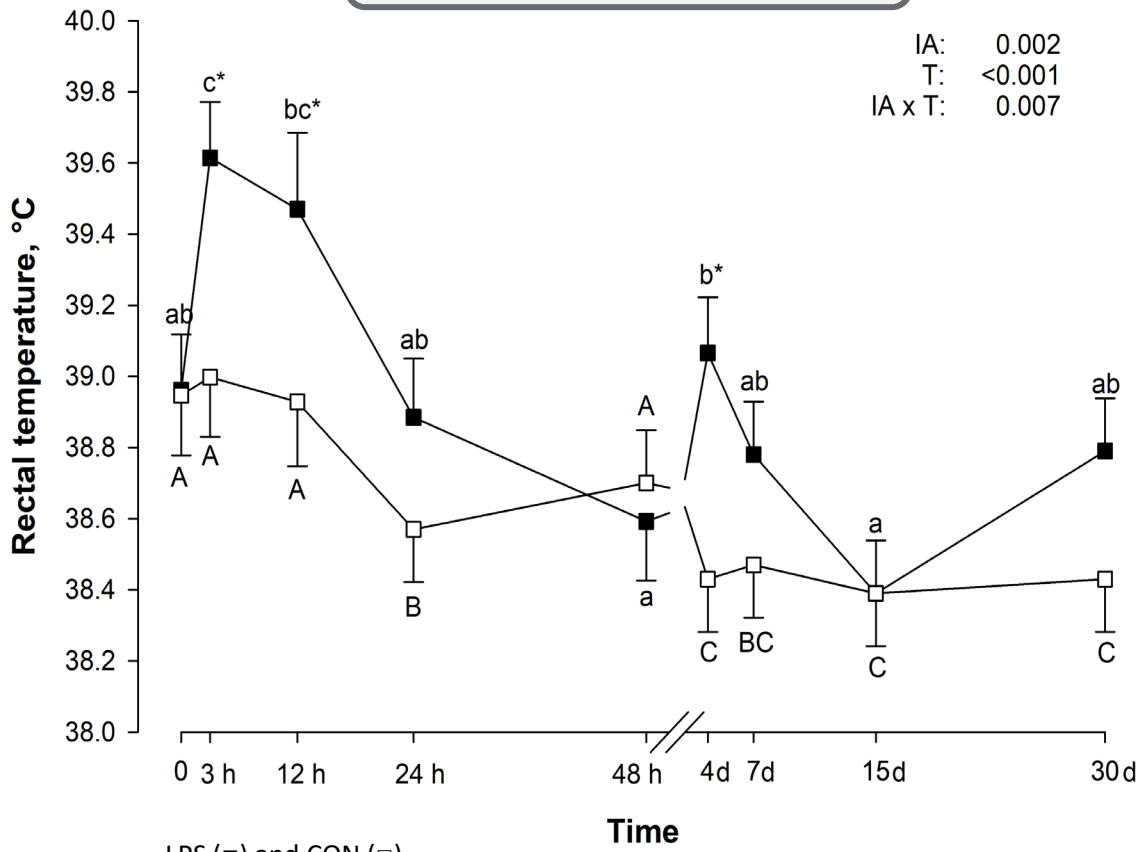
↑ Rectal temperature

Salama et al. (2020)
Gross et al. (2020)

× Plasma immunoglobulins

× Serum metabolites

Rectal temperature



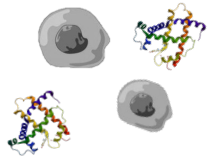
LPS (■) and CON (□)
*Significant differences between groups
[a-c /A-C] Significant differences throughout time within group

Main findings (goats)

- Immune response

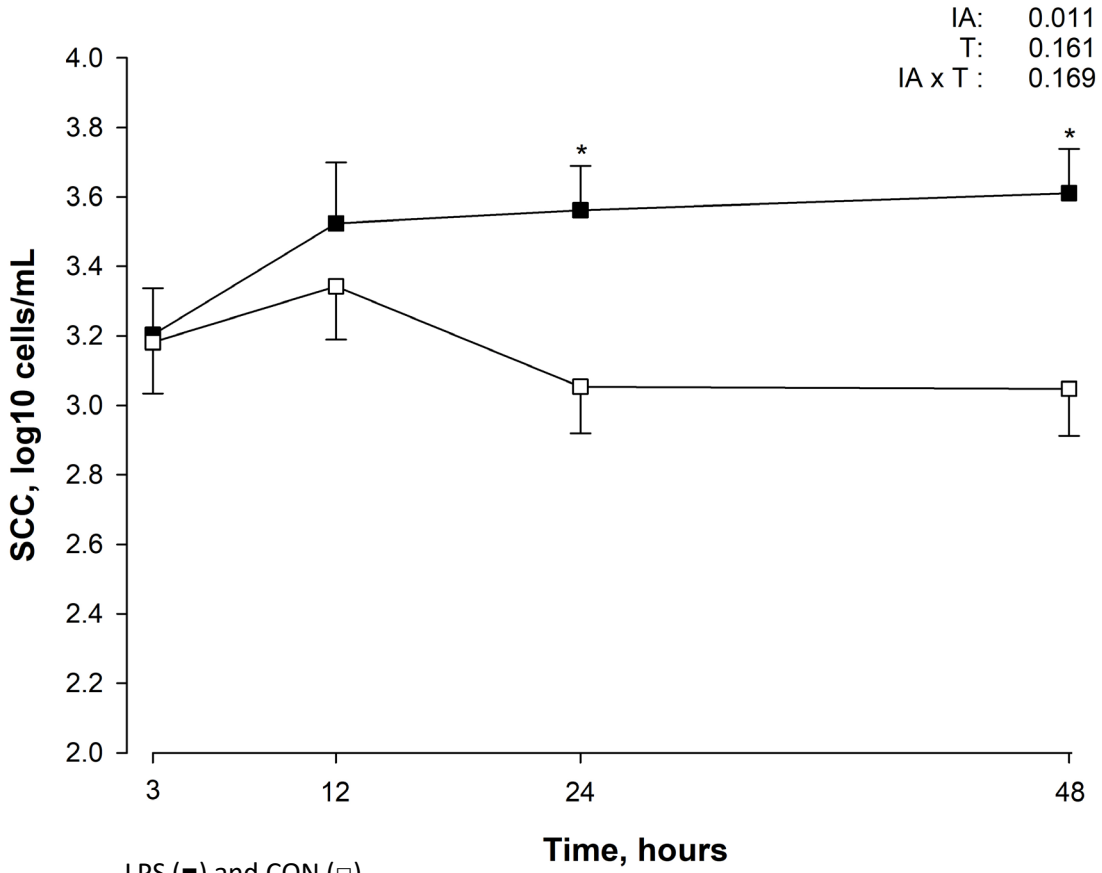
  van Oostveldt et al. (2002)

  Werner-Misof et al. (2007)

[LPS] →  ↑

✓ Species

Somatic cell count (SCC)



LPS (■) and CON (□)

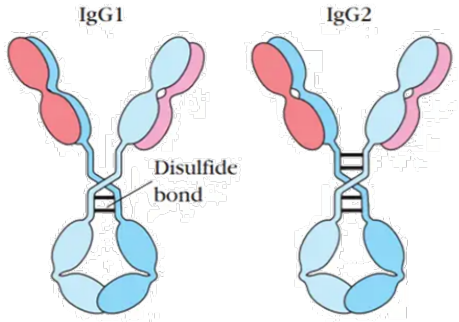
*Significant differences between groups

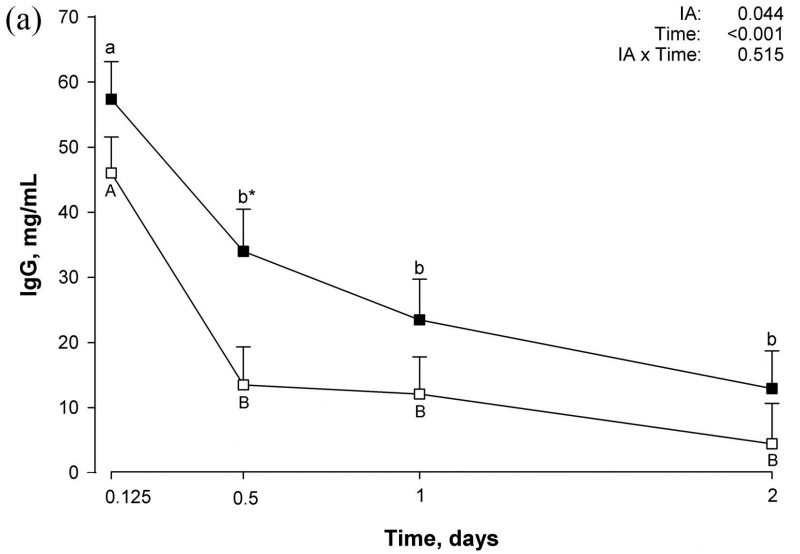
Main findings (goats)

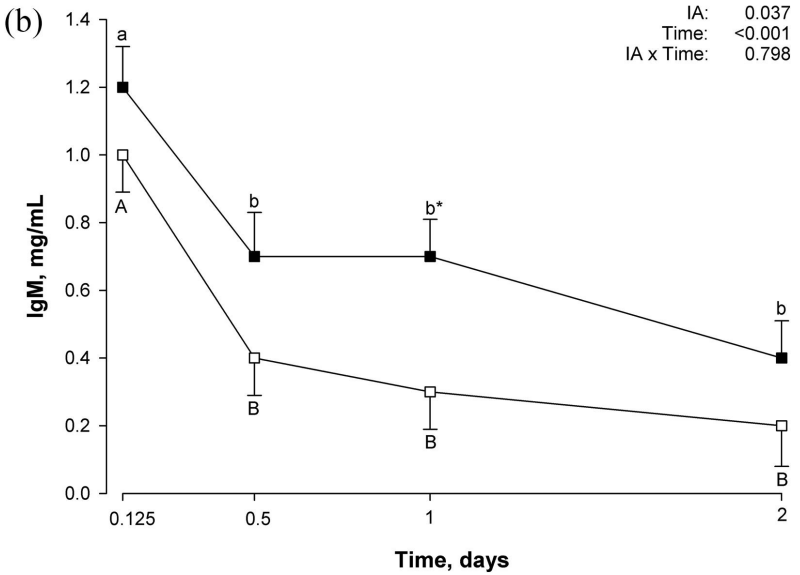
Colostrum IgG and IgM

- BMB permeability

Wellnitz et al. (2013), Lehmann et al. (2013)







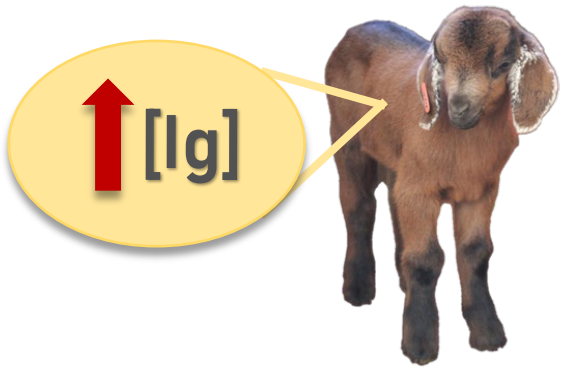
LPS (■) and CON (□)
*Significant differences between groups
$^{a\text{-}b}$ /$^{A\text{-}B}$ Significant differences throughout time within group

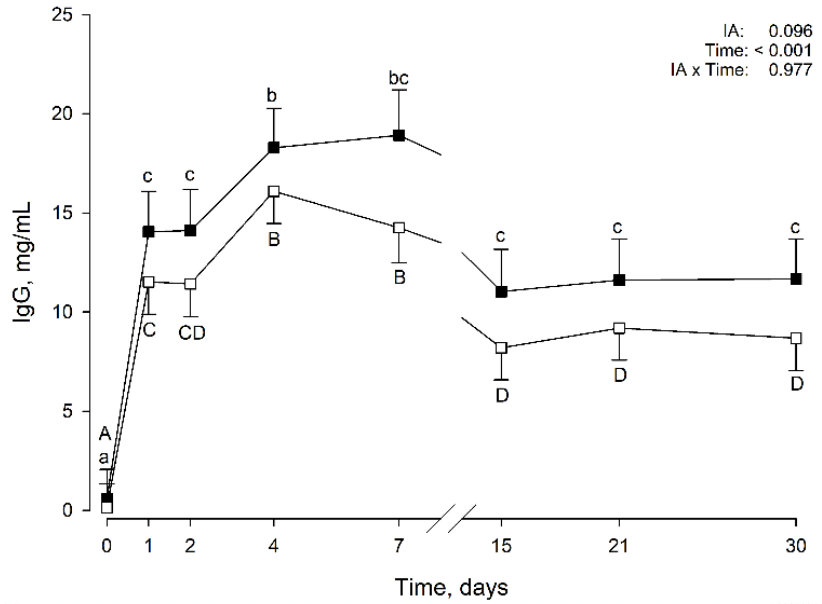
Main findings (goat kids)

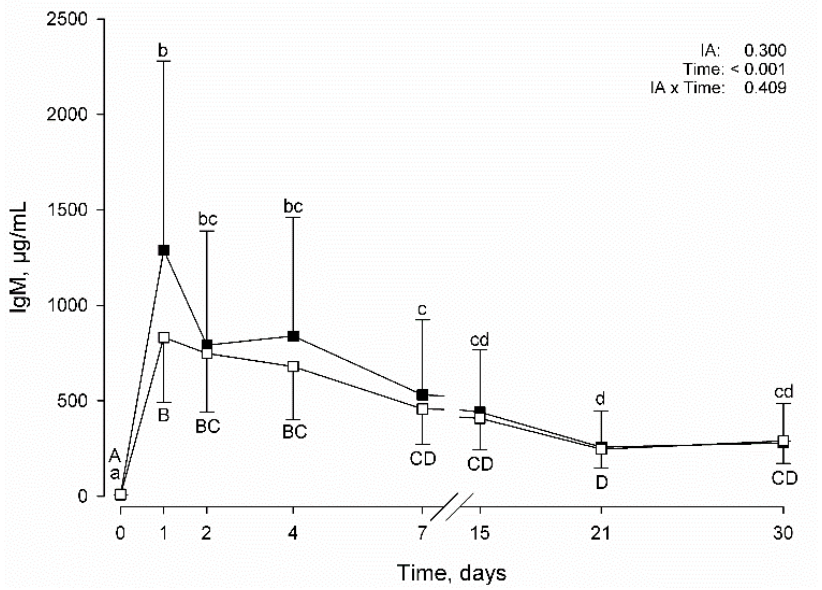
	LPS group	CON group
IgG mg/mL	45.3 ± 4.43	28.0 ± 4.47
IgM mg/mL	0.8 ± 0.08	0.5 ± 0.08

- Colostrum ↑ [Ig]

Castro et al. (2005)
Rodríguez et al. (2009)







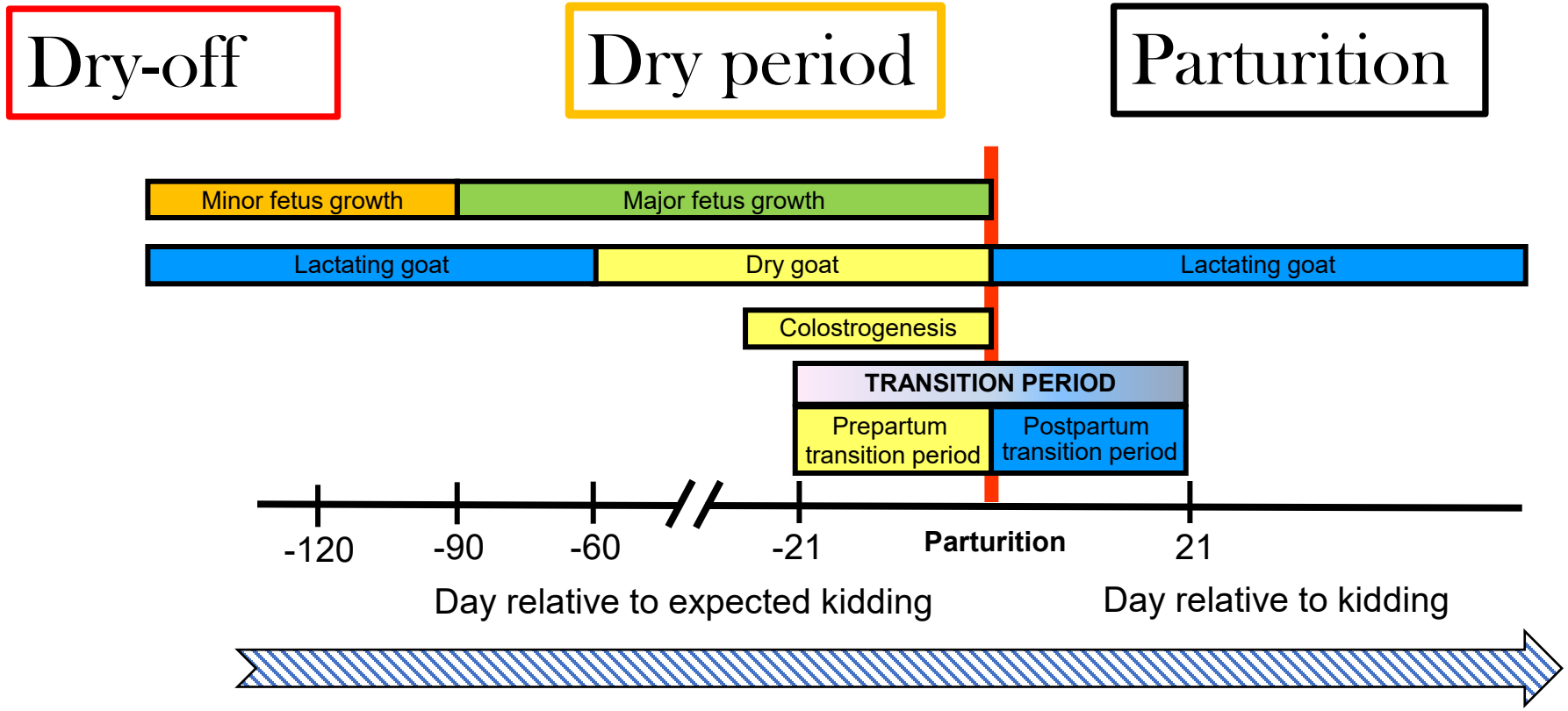
LPS (■) and CON (□)
*Significant differences between groups
a-d /A-D Significant differences throughout time within the group

Conclusions

Intramammary administration of LPS

- Enhanced colostrum immunoglobulins concentrations
- Tend to increase plasma IgG concentration in goat kids

Future perspectives



Thank you for your attention

Funding

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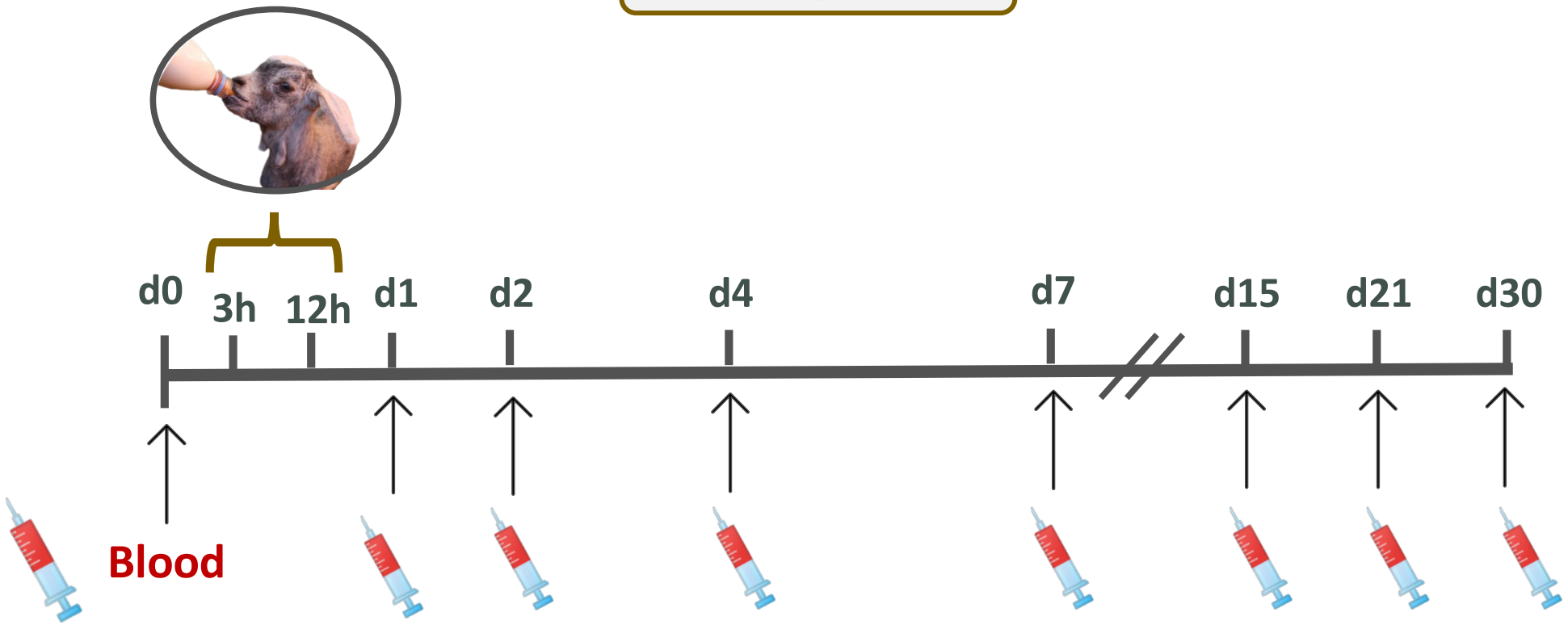
Material and Methods

Sampling



Animal experiment procedure: OEBA-ULPGC 28/2021

Material and Methods

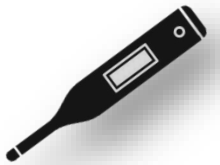
Variables

Blood

- Plasma IgG and IgM

- Serum

Glucose, calcium, lactate dehydrogenase and total proteins.



- Rectal temperature
- Milk intake
- Body weight

Statistical analysis

Mixed procedure

Repeated measure: Time
Subject: Animal
Bonferroni's test, p-value ≤ 0.05