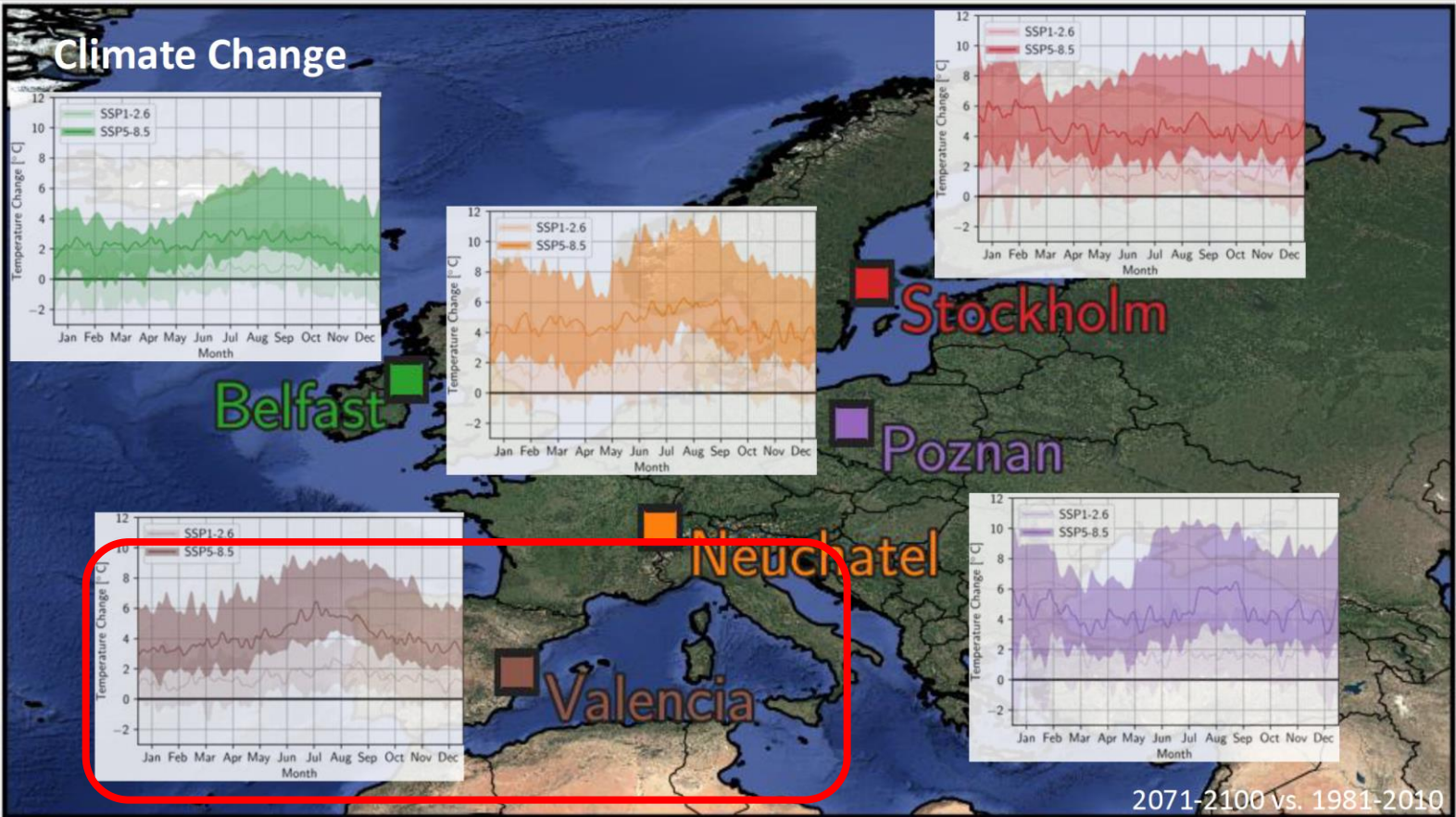


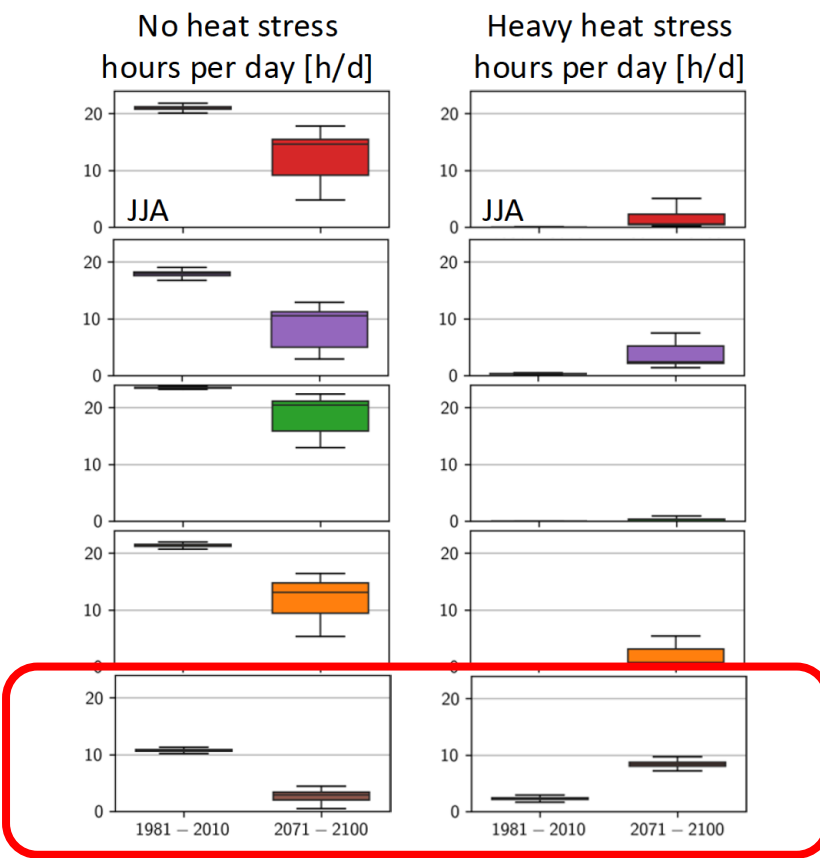
Dietary supplementation with buffer and protected amino acids improves milk production and modulates microbiota in heat-stressed primiparous dairy goats

E. Romera-Recio, E. Ramos, M. Romero-Huelva, I. Rivelli, J. Barroso, A. Gomez-Mesonero, D. R. Yanez-Ruiz

Context: climate change

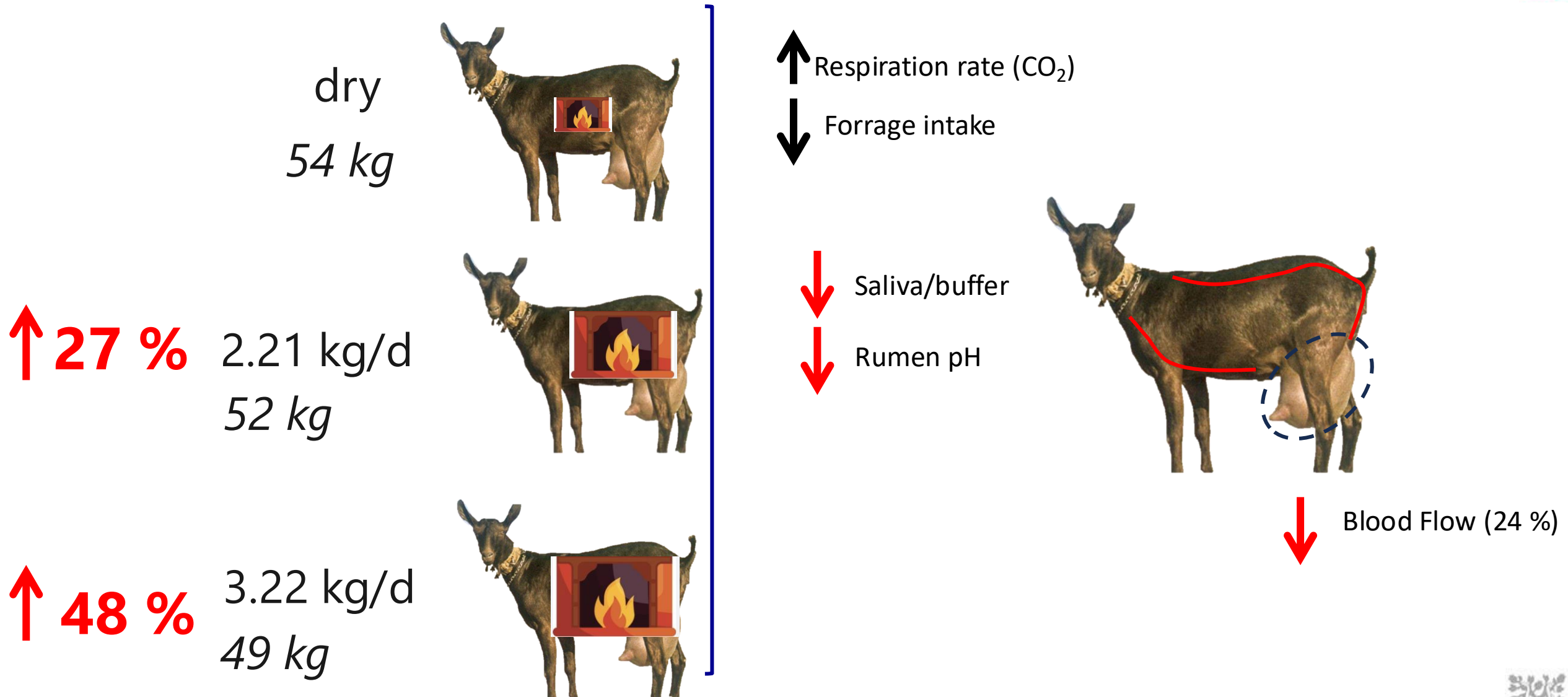


Animal welfare

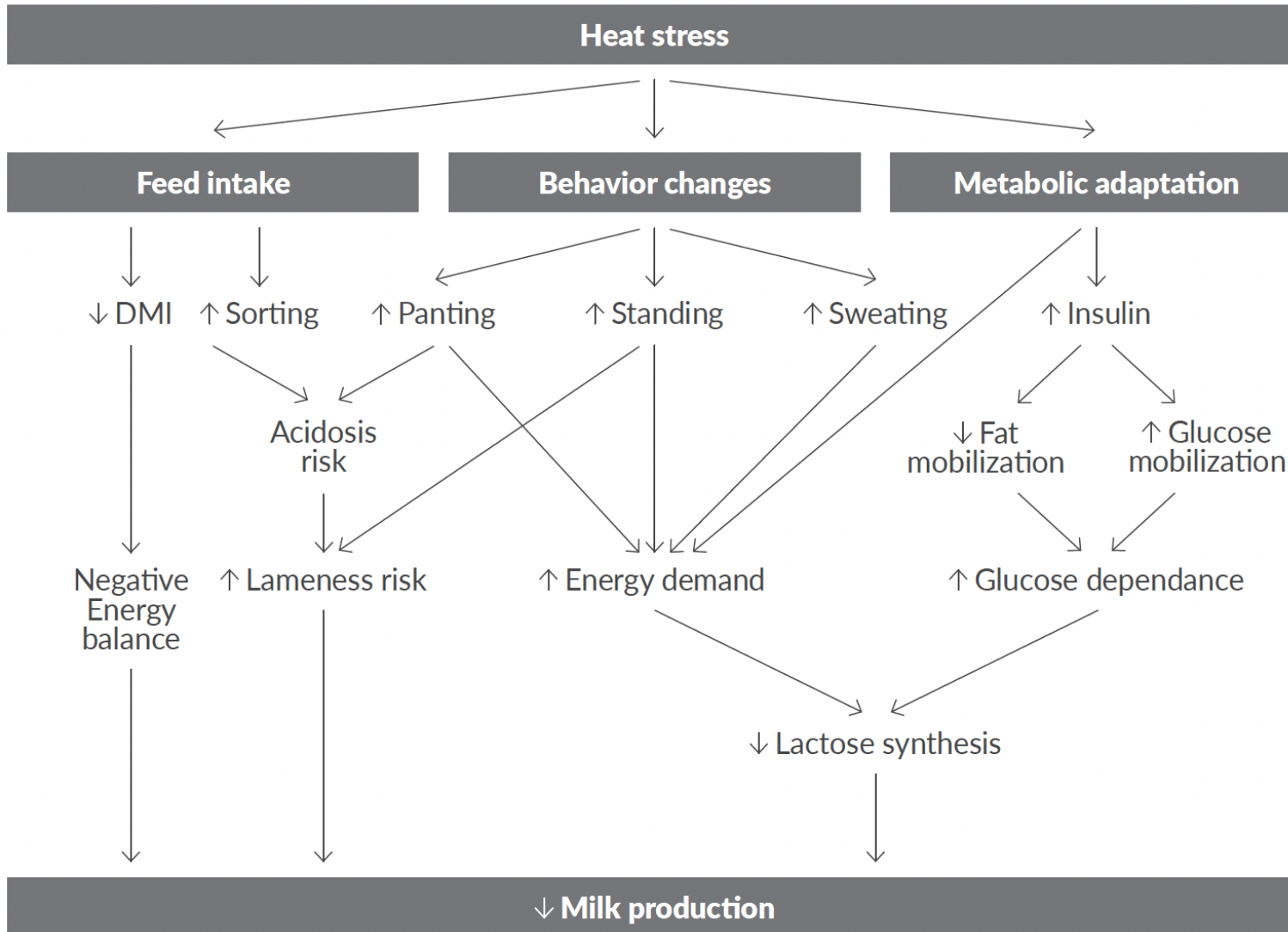


1981-2010 ----- 2071 - 2100

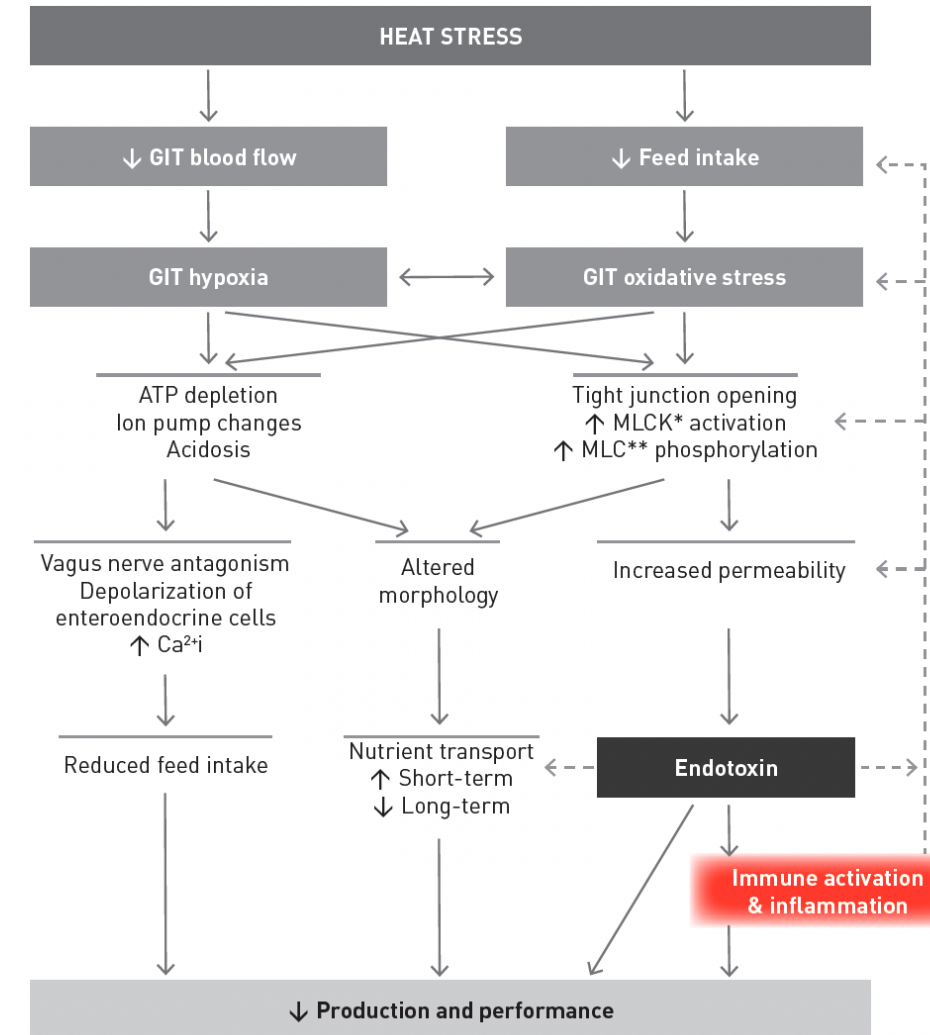
Context: intensification dairy goats systems



Heat stress



Microbiome????



Housing

- Insolation
- Shade and bedding
- Ventilation
- Drinking water
- Misting

Feeding

- Feeding times /frequency
- Feed ingredients
- Energy density
- Feed additives



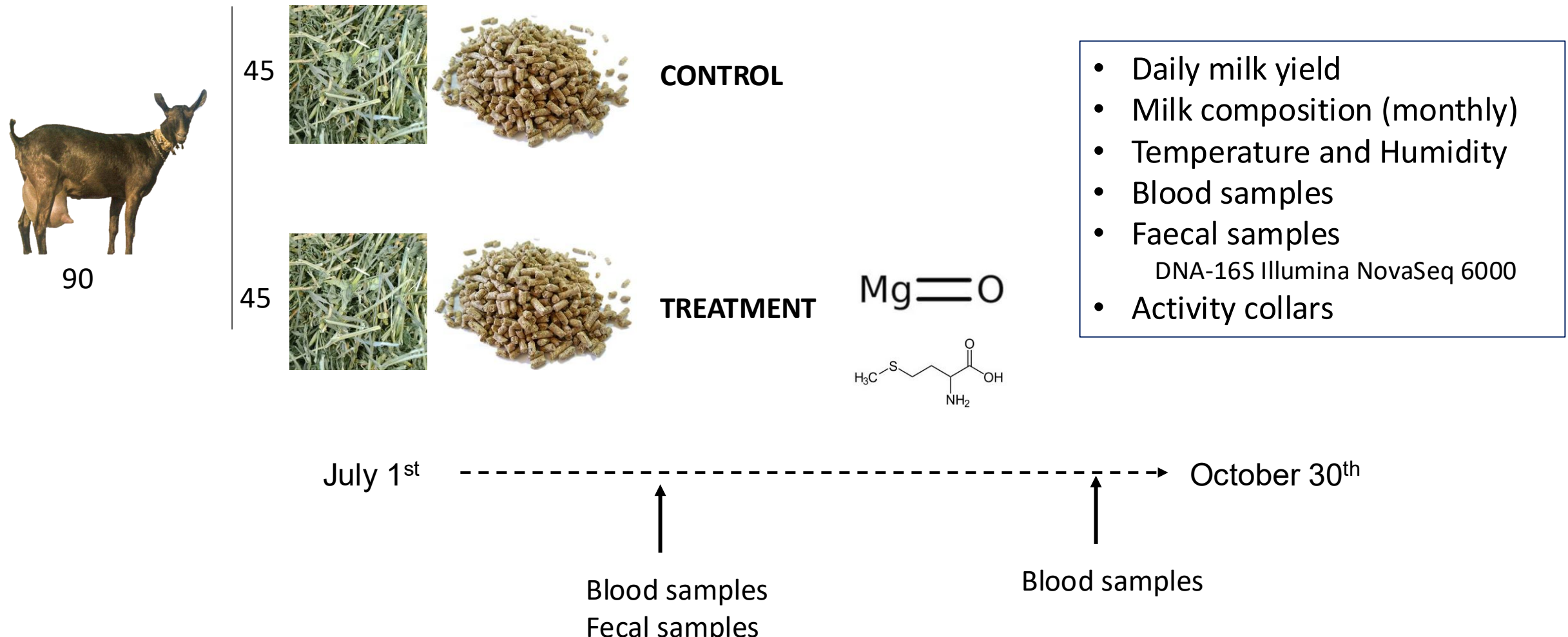
1. Electrolites
2. Pre, pro y postbitics
3. Fitogenics
4. Vitamins y minerals

Genetics

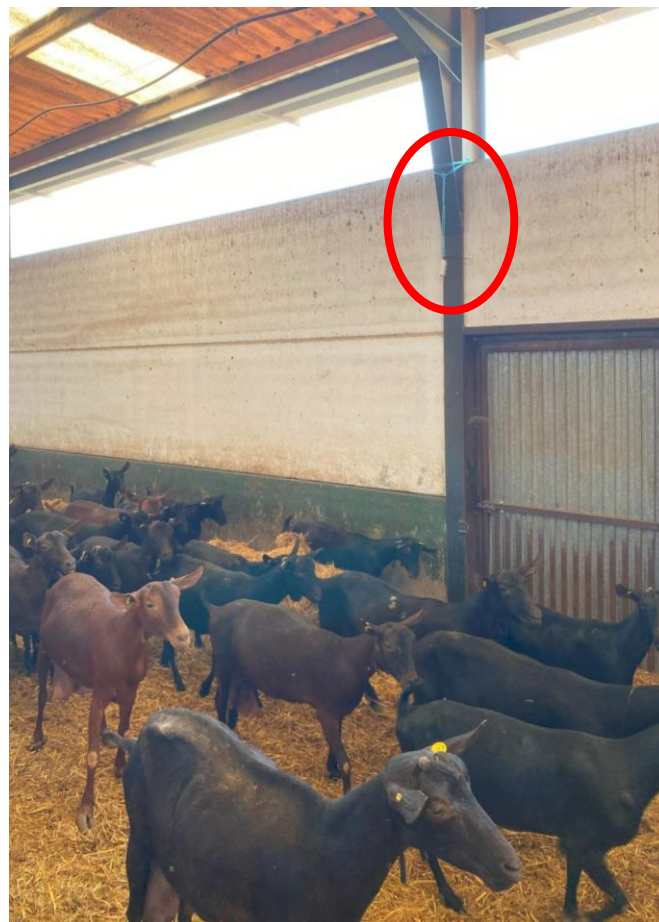
Objective + methods



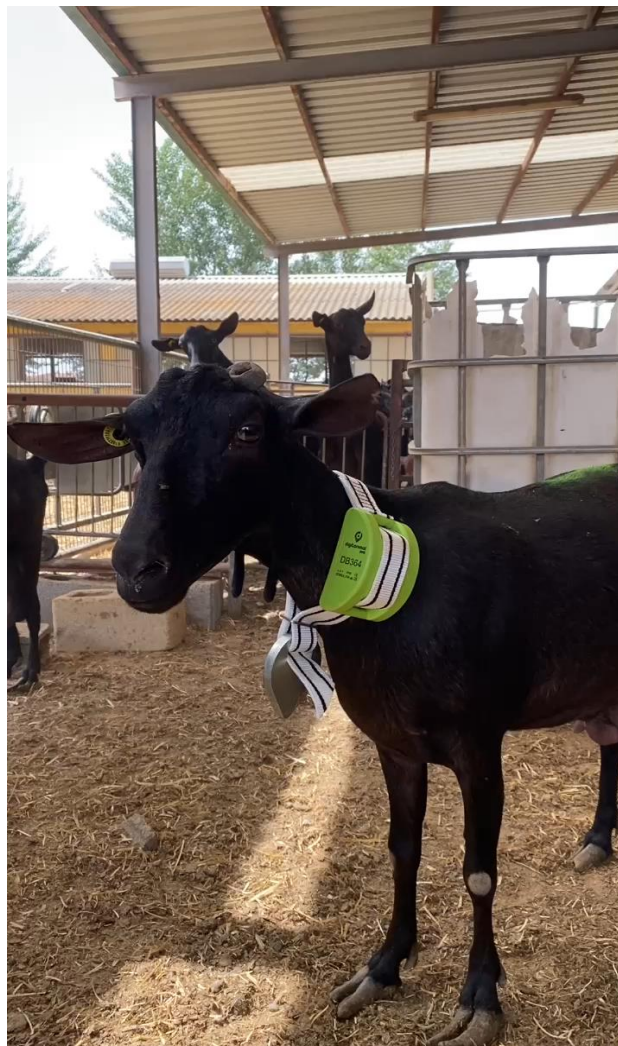
to evaluate the impact of a specific **dietary supplement** on dairy goats under heat stress conditions



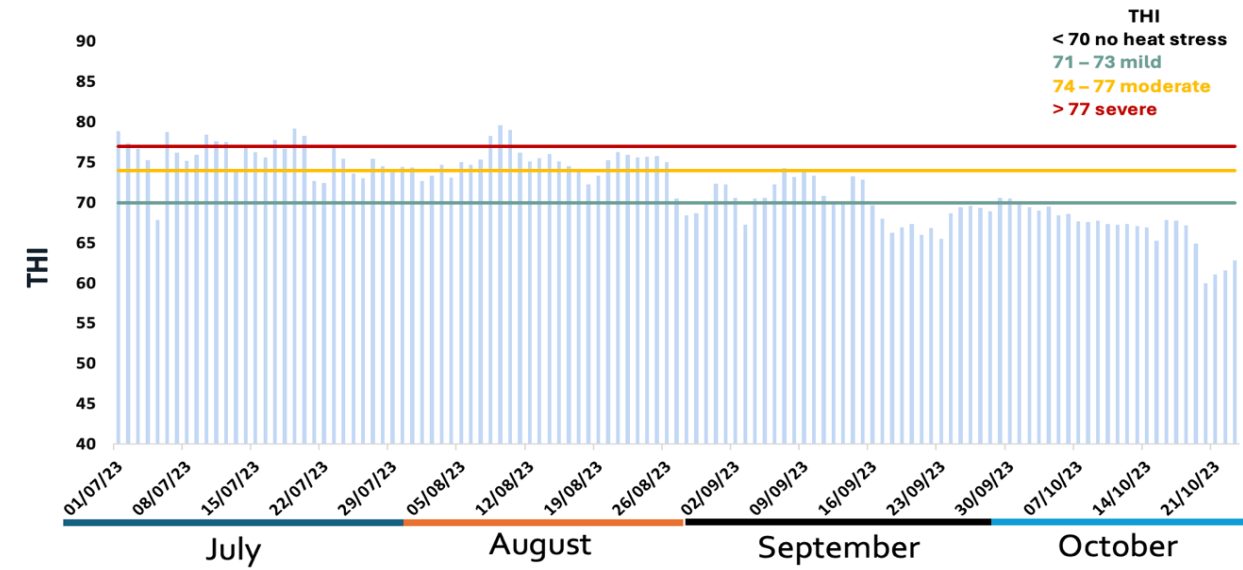
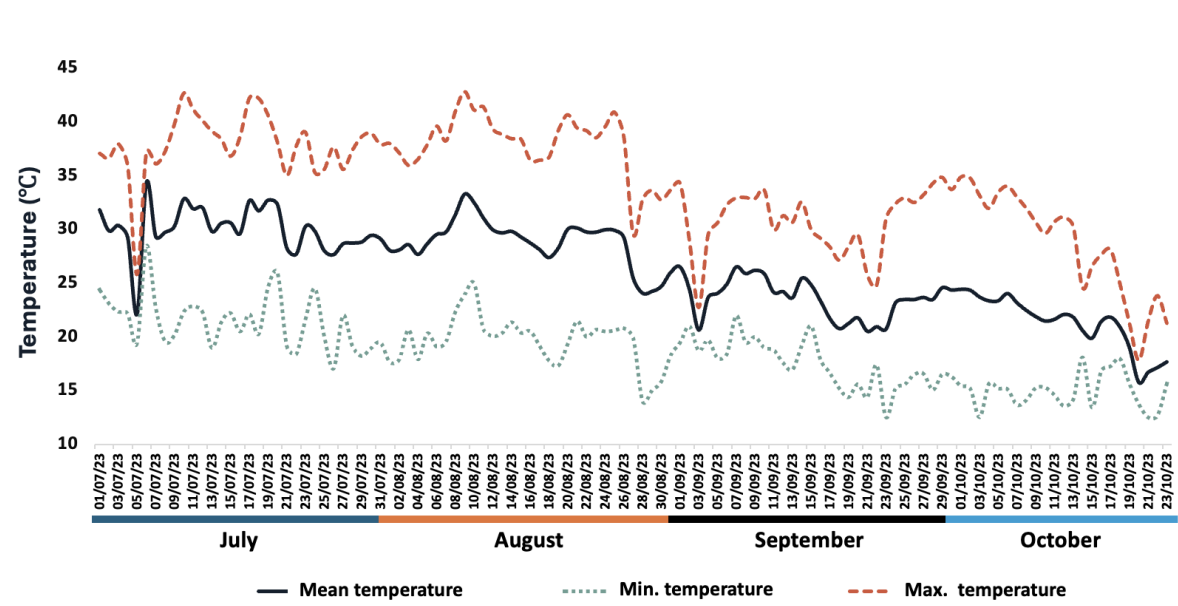
Objective + methods



Objective + methods



Results: THI

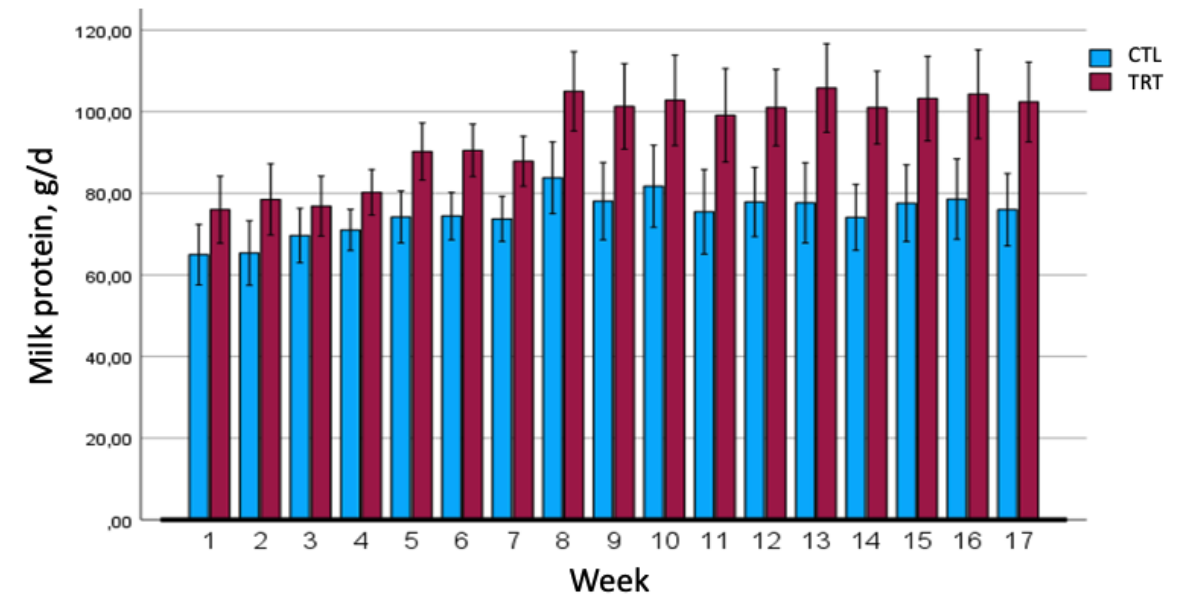
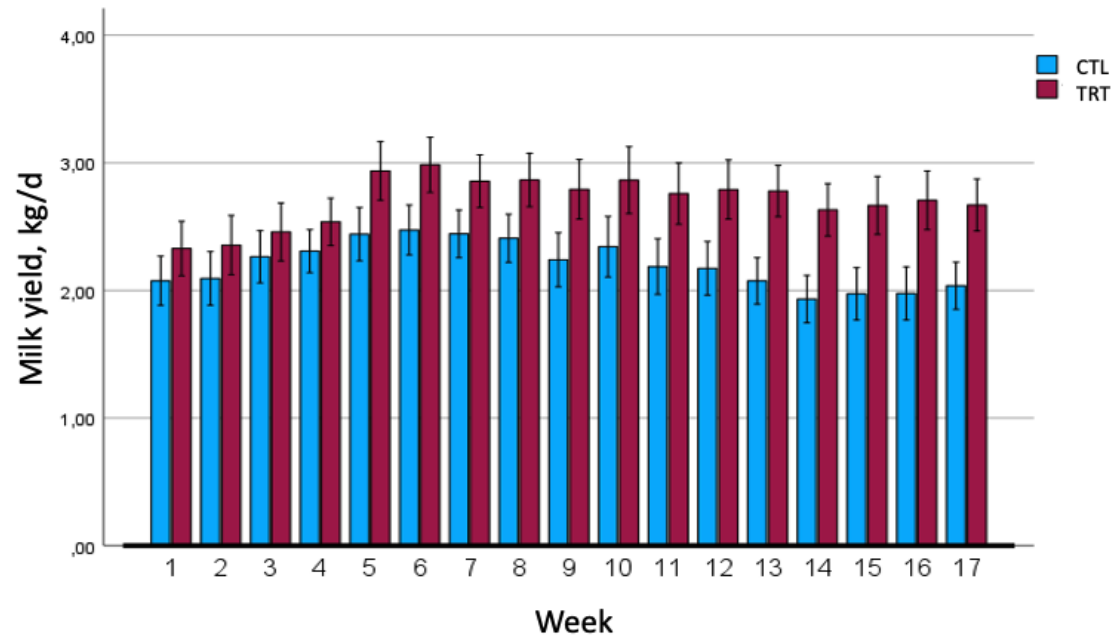


Results: milk yield



	Control	Treatment	<i>EEM</i> ¹	<i>P</i> -valor		
				Diet	Time	D * T
MULT + PRIM ²						
Milk yield, kg / d	3,02	2,83	0,116	0,383	<0,001	0,043
Fat yield, g / d	137,3	121,9	6,34	0,150	0,116	0,199
Protein yield, g / d	103,7	99,4	4,23	0,582	0,532	0,409
Cheese extract, g / d	186,0	175,5	11,2	0,615	<0,001	0,089
MULT						
Milk yield, kg / d	3,25	2,92	0,140	0,199	<0,001	0,076
Fat yield, g / d	147,3	127,2	7,84	0,116	0,070	0,377
Protein yield, g / d	111,0	102,6	5,15	0,366	0,406	0,362
Cheese extract, g / d	197,1	184,4	15,4	0,660	<0,001	0,671
PRIM						
Milk yield, kg / d	1,93	2,65	0,147	0,011	0,035	0,383
Fat yield, g / d	89,5	111,5	6,81	0,060	0,892	0,450
Protein yield, g / d	68,9	93,0	5,43	0,020	0,344	0,422
Cheese extract, g / d	151,3	199,0	12,3	0,030	<0,001	0,418

Results: milk yield



Results: blood parameters



Table 1. Mean blood parameters for primiparous and multiparous goats.

Item		CTL		TRT		SEM	P-values ¹					
		July	October	July	October		T	L	P	TxL	TxP	LxP
Primiparous												
	Albumin, (g/L)	37.0	39.5	39.2	43.3	0.97	0.14	0.92	0.02	0.45	0.33	0.57
	ALP ² , (U/L)	104	186	169	210	34.6	0.16	0.03	0.00	0.81	0.13	0.33
	ALT ³ , (U/L)	14.7	17.7	16.7	18.5	1.02	0.12	0.98	0.00	0.29	0.31	0.31
	AST ⁴ , (U/L)	49.3	48.6	50.0	53.9	3.81	0.97	0.69	0.88	0.34	0.31	0.65
	BHB ⁵ (mg/dL)	7.7	4.12	8.31	5.18	1.19	0.69	0.00	0.00	0.44	0.38	0.07
	Cholesterol, (mg/dL)	116	115	103	125	7.51	0.11	0.89	0.74	0.63	0.01	0.03
	Glucose, (mg/dL)	34.6	53.9	49.3	59.6	2.82	0.00	0.00	0.21	0.33	0.00	0.68
	NEFA (mmol/L)	0.56	0.63	0.42	0.49	0.32	0.03	0.49	0.03	0.96	0.91	0.00
	Total protein(g/L)	77.1	76.2	74.0	76.9	1.5	0.08	0.55	0.14	0.09	0.05	0.00
	Triglycerides, (mg/dL)	17.1	19.4	14.0	20.6	1.64	0.07	0.20	0.50	0.88	0.06	0.12
	Creatinine, (mg/dL)	0.56	0.51	0.54	0.53	0.02	0.59	0.05	0.80	0.99	0.32	0.09
Multiparous												
	Albumin, (g/L)	36.9	40.1	37.7	41.8	1.07	0.14	0.92	0.02	0.45	0.33	0.57
	ALP ² , (U/L)	73.7	86.9	145	210	33.7	0.16	0.03	0.00	0.81	0.13	0.33
	ALT ³ , (U/L)	14.7	16.3	14.9	16.7	0.96	0.12	0.98	0.00	0.29	0.31	0.31
	AST ⁴ , (U/L)	48.4	49.5	43.5	46.4	3.67	0.97	0.69	0.88	0.34	0.31	0.65
	BHB ⁵ (mg/dL)	13.4	5.36	12.2	7.20	1.19	0.69	0.00	0.00	0.44	0.38	0.07
	Cholesterol, (mg/dL)	114	131	106	128	5.41	0.11	0.89	0.74	0.63	0.01	0.03
	Glucose, (mg/dL)	31.8	51.4	49.3	54.7	1.93	0.00	0.00	0.21	0.33	0.00	0.68
	NEFA (mmol/L)	0.74	0.51	0.56	0.37	0.20	0.03	0.49	0.03	0.96	0.91	0.00
	Total protein(g/L)	79.6	83.9	80.5	84.4	1.45	0.08	0.55	0.14	0.09	0.05	0.00
	Triglycerides, (mg/dL)	18.2	17.1	15.4	15.5	1.31	0.07	0.20	0.50	0.88	0.06	0.12
	Creatinine, (mg/dL)	0.57	0.57	0.55	0.53	0.02	0.59	0.05	0.80	0.99	0.32	0.09

Primiparous vs. Multiparous goats



Feature	Primiparous (1st Lactation)	Multiparous (2+ Lactations)
Metabolic Heat Production	Lower (produce less milk).	Higher (massive internal heat from high production).
Surface Area to Mass	Higher (smaller bodies = easier to dissipate heat).	Lower (large body mass retains heat longer).
Thermoregulatory Ability	Less experienced; higher heart rates under stress.	Better at "pumping" blood to skin, but easily overwhelmed.
Behavioral Strategy	Often "bullied" away from fans/water by older cows.	Dominate the best cooling spots; eat more in fewer visits.
Primary Risk	Growth Stunting & Future Fertility.	Acute Metabolic Collapse & Severe Milk Drop.

Results: fecal microbiota in primiparous goats



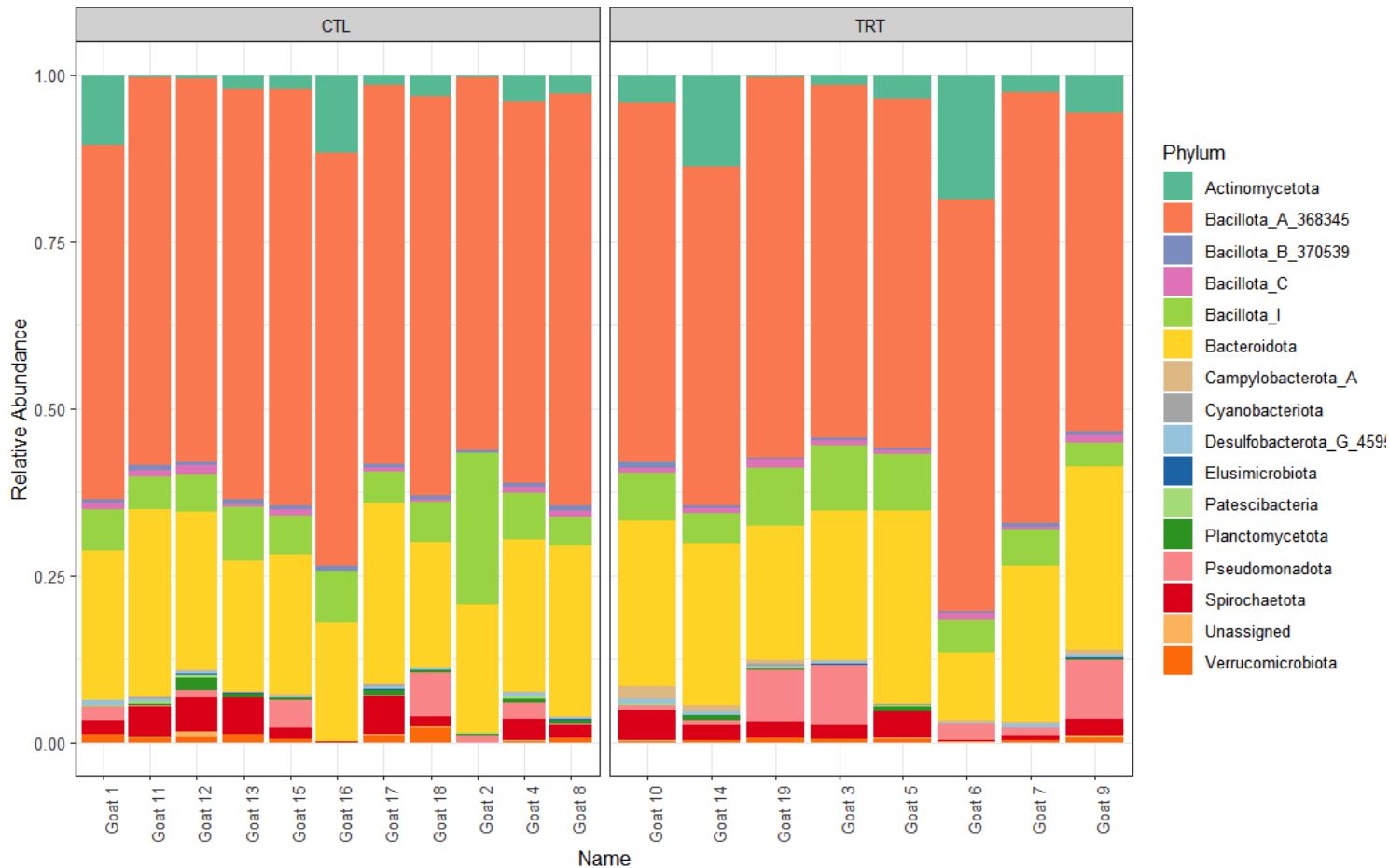
Diversity

	n	Observed ASVs	SEM	Shannon	EM	Simpson	Simpson SEM
CTL	11	781	29.1	5.56	0.119	0.988	0.003
TRT	8	819	23.4	5.48	0.106	0.985	0.004
p-value (Kruskal-Wallis)		0.509		0.216		0.283	

Results: fecal microbiota in primiparous goats

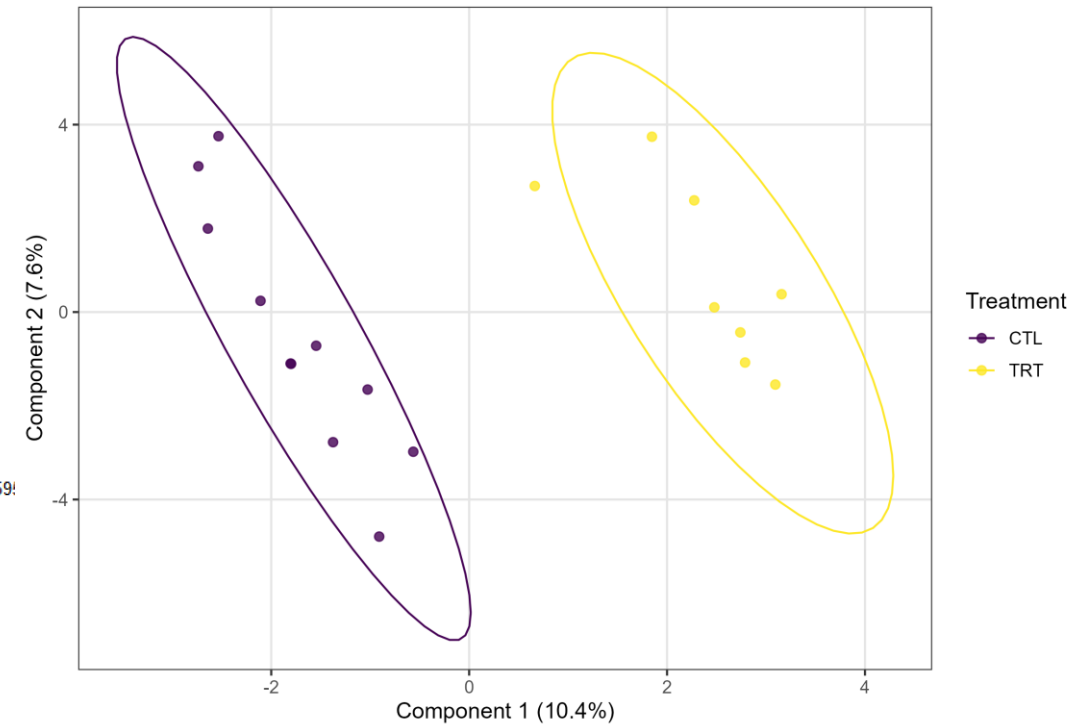


Relative abundance



sPLS-DA - Feces

PERMANOVA $p = 0.001$, $R^2 = 0.453$, $F = 14.1$



Results: fecal microbiota in primiparous goats



Bacteria that were differently abundant in fecal material of goats in CTL and TRT groups.

log2Fold Change	Phylum	Class	Order	Family	Genus
-10,1	Bacteroidota	Bacteroidia	Bacteroidales	Rikenellaceae	Alistipes_A_871400
-9,85	Bacillota_I	Bacilli_A	RF39	UBA660	UBA3789
-6,42	Bacillota_A_368345	Clostridia_258483	TANB77	CAG-508	Unassigned
-8,48	Verrucomicrobiota	Verrucomicrobiae	Verrucomicrobiales	Akkermansiaceae	Akkermansia
-10,6	Bacteroidota	Bacteroidia	Bacteroidales	UBA932	Cryptobacteroides
-27,6	Verrucomicrobiota	Verrucomicrobiae	Verrucomicrobiales	Akkermansiaceae	Akkermansia
-8,05	Verrucomicrobiota	Kiritimatiellia	RFP12	UBA1067	UBA1067
-26,6	Bacteroidota	Bacteroidia	Bacteroidales	Paludibacteraceae	RF16
2,16	Bacillota_A_368345	Clostridia_258483	Oscillospirales	Acutalibacteraceae	Ruminococcus_E
7,74	Actinomycetota	Actinomycetes	Actinomycetales	Bifidobacteriaceae	Bifidobacterium_388775
2,61	Campylobacterota_A	Campylobacteria	Campylobacterales	Campylobacteraceae	Campylobacter_A_477085
4,49	Verrucomicrobiota	Verrucomicrobiae	Opitutales	CAG-312	UMGS1490

- Challenging environmental context that dairy goats face in summer (July and August)
- Additives in the diet based on buffer and protected amino acids promoted an improvement of the milk production and energy metabolism
- Only in primiparous animals
- Improved condition of primiparous animals under the additive treatment was associated with the abundance of some fecal bacterial groups

Thank you for your attention!!

