

Incorporation of butyric and caproic acids into milk replacers for calves fed twice daily



WASHINGTON STATE
UNIVERSITY

 **trouw nutrition**
a Nutreco company

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Composition of the fat blends in milk replacers



Vegetable sources (Europe and other parts of the world)

Variations in fatty acid (**FA**) and triglyceride (**TG**) structure, which



Animal sources (mostly North America)

Lipid metabolism

Gut microbiome

Oxidative stress

Inflammation

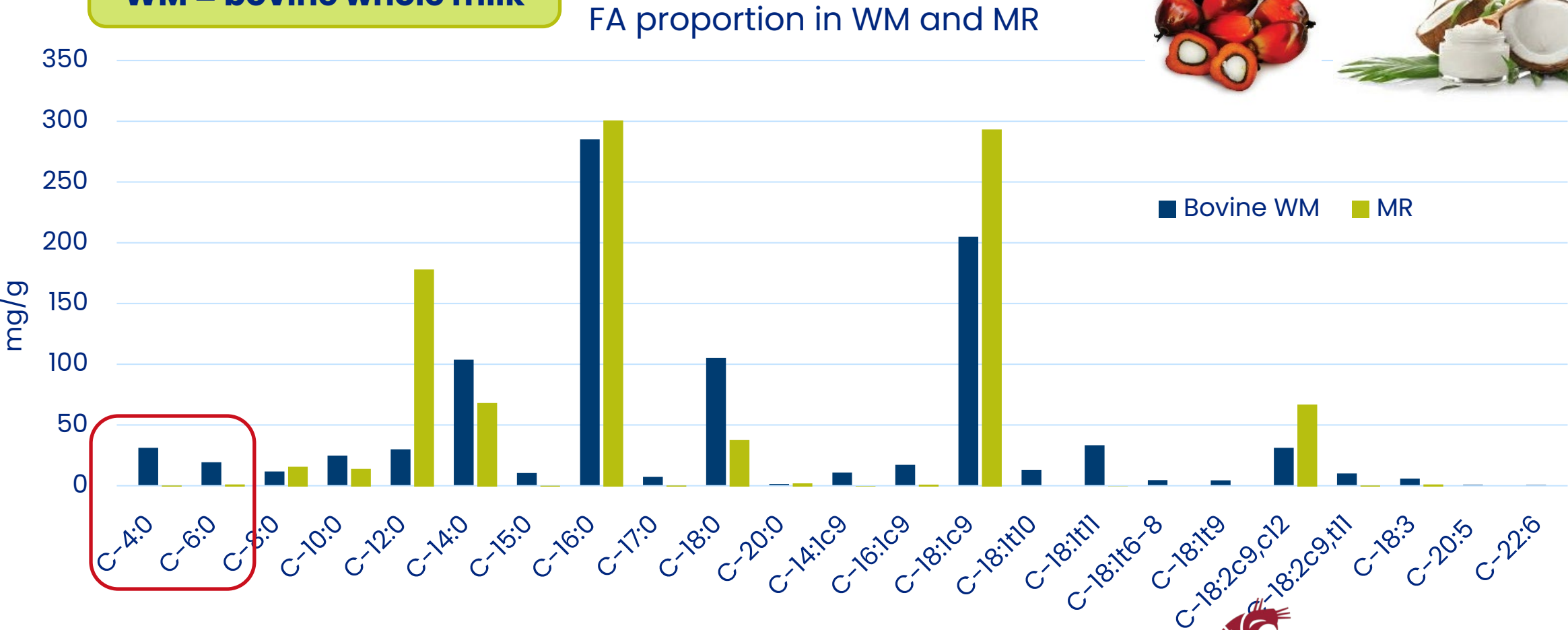
Digestibility

Abomasal emptying

C4:0 and C6:0 are missing from milk replacers !

MR = milk replacer
WM = bovine whole milk

65% Palm : 35% Coconut

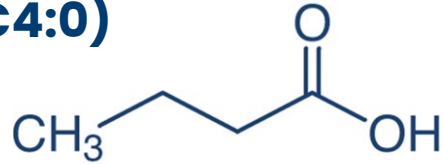


Aurousseau et al., 1983, 1984; Moate et al., 2007; Guilloteau et al., 2010; G6rka et al., 2011; Liu et al., 2021, 2022; Dell'Anno et al., 2023.

Biological relevance of C4:0 and C6:0

Essential for calf development

Butyric (C4:0)



- Lower diarrhea frequencies
- Enhanced rumen papillae development
- Enhanced intestinal development
- Enhanced digestive secretions
- Improved insulin sensitivity
- Higher ADG

3.1 – 5.6% total FA

Caproic (C6:0)



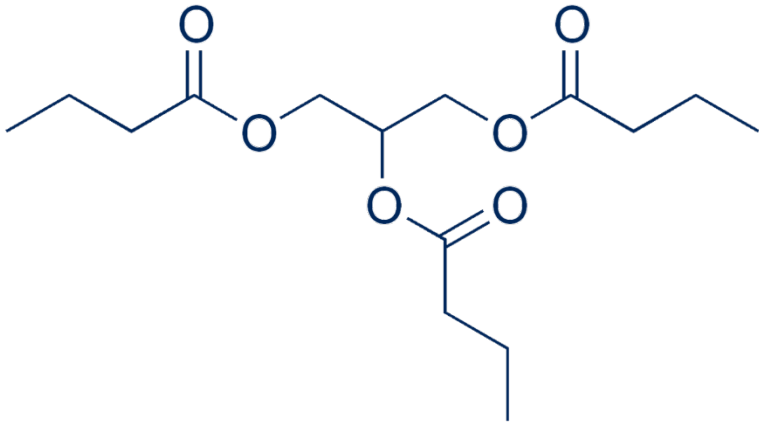
- Higher ADG
- Antibiotic effect across species

2.2 – 2.8% total FA

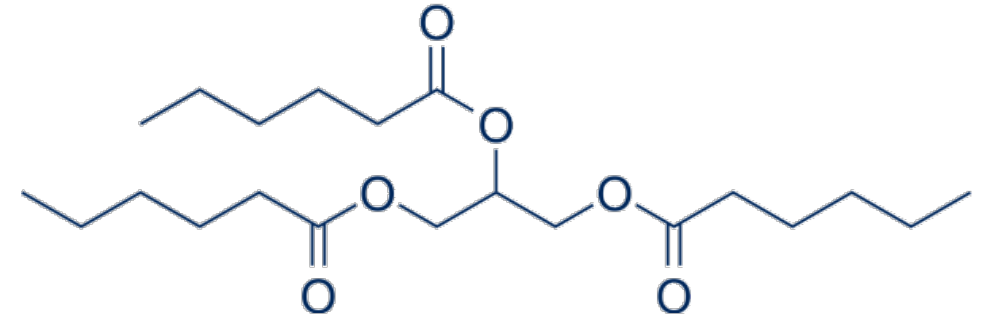
Can be obtained from coconut and palm kernel fats – **less than 1% of the total FA in both fats** (needs supplementation)

Tributyryn and tricaproin supplementation

Tributyryn (TB)



Tricaproin (TC)



Strong astringent taste – **may negatively affect palatability**

Objective

Evaluate the effect of incorporating **TB and TC** into milk replacer (**MR**) on feed intakes, growth, and health of 18 days-old calves.

Hypothesis

1. Incorporation of **TB** and **TC** into MR would negatively affect the **acceptance** of the MR by calves.

2. Feeding milk replacer incorporated with **TB** and **TC** would **reduce the incidence** of diarrhea and the number of calves treated for the disease.



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Experimental design

ORIGIN	Collection center
BW AT ARRIVAL	47.5 kg
BLOCKING	Arrival day, age, and BW

15 calves per treatment

Milk replacer fed at **13.5% solids**
Twice a day (**3.5 L/ meal**)

Day 1 of life



Holstein, male calves

Day 18.4 ± 2.4 of life
Experimental d 1 – 28

Individually
housed



Bucket-fed

Day 81.4 ± 2.4 of life
Experimental d 29 – 63

Group
housed



Gradually weaned
from **experimental**
d 36 – d 50

Experimental design

**62.7% palm, 35% coconut, and
2.3 % linseed** (% total fat)

CONTROL

2.40% (% FA)
TRIBUTIRIN (**TB**)

2.34% (% FA)
TRICAPROIN (**TC**)

2.41% (%FA) TB
+ 2.10% (%FA) TC

All MR were
**isoenergetic and
isonitrogenous** with:

- 33.9% Lactose
- 29.2% CF
- 24.3% CP

To mimic the amount of C4:0 and
C6:0 in milk fat

Assessments



Feed intakes



Fecal Scores



BW and body
measurements



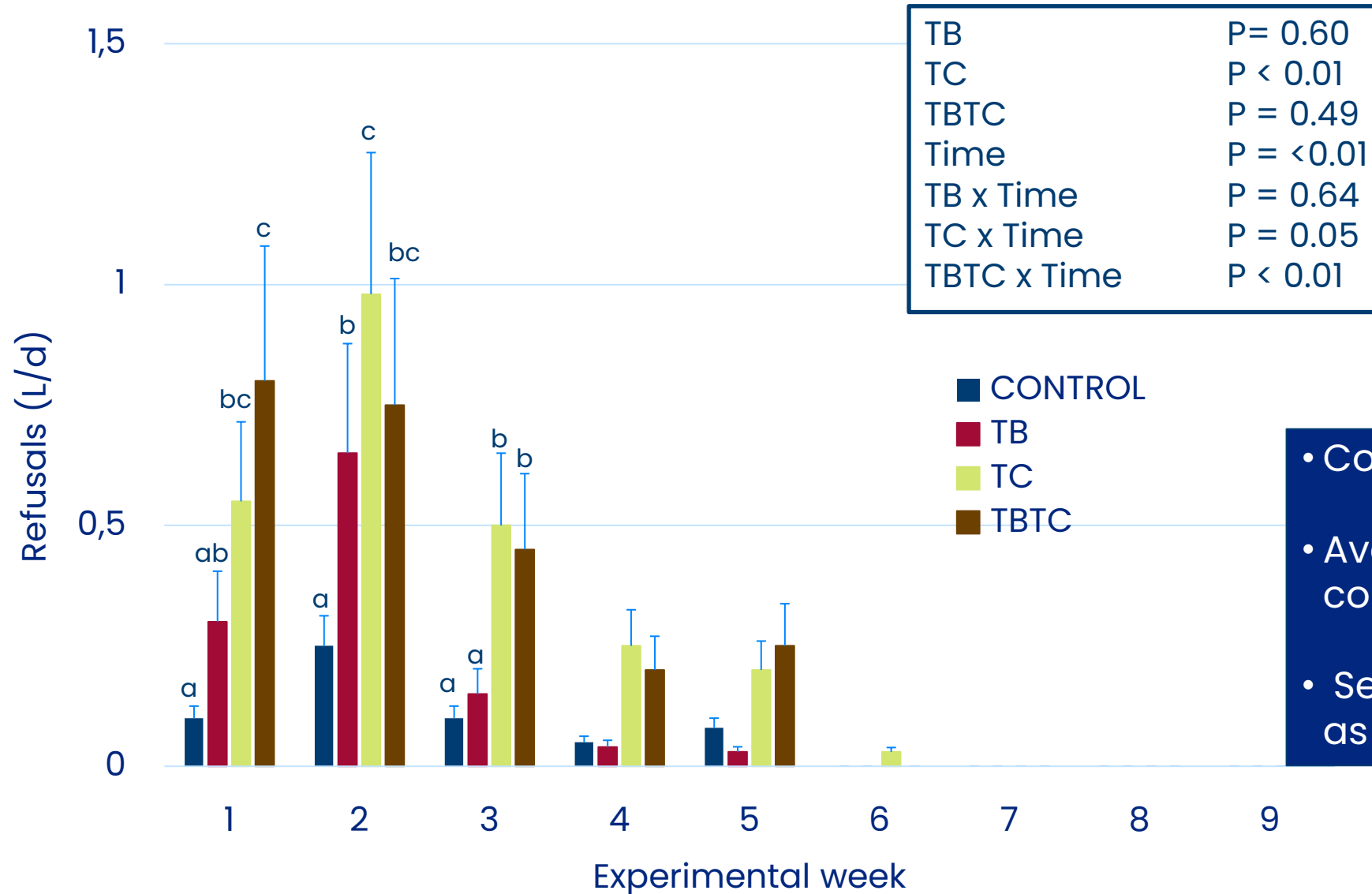
Health

Growth and feed intakes

Item	Treatment				Pooled SEM	P-value						
	CON	TB	TC	TBTC		TB	TC	TBTC	Week (W)	TB×W	TC×W	TBTC×W
BW												
Initial, kg	47.4	47.5	47.4	47.9	1.80	0.87	0.89	0.99	–	–	–	–
Final, kg	73.6	74.1	72.2	72.8	1.60	0.73	0.43	0.97	<0.01	0.99	0.57	0.22
Intake												
MR, L/d	5.9	5.8	5.6	5.6	0.07	0.39	0.01	0.01	<0.01	0.64	0.05	<0.01
Starter, kg/d	1.0	1.1	1.0	1.0	0.09	0.61	0.85	0.77	<0.01	0.99	0.36	0.52
Straw, g/d	59	72	72	55	13.20	0.47	0.47	0.84	<0.01	0.68	0.99	0.09
Water, L/d	3.0	3.3	3.3	3.1	0.29	0.48	0.43	0.87	<0.01	0.96	0.77	0.27

TB×W = TB Treatment by time interaction
 TC×W = TC Treatment by time interaction
 TBTC×W = TBTC Treatment by time interaction

Increased milk refusals with TB and TC supplementation



Neophobia

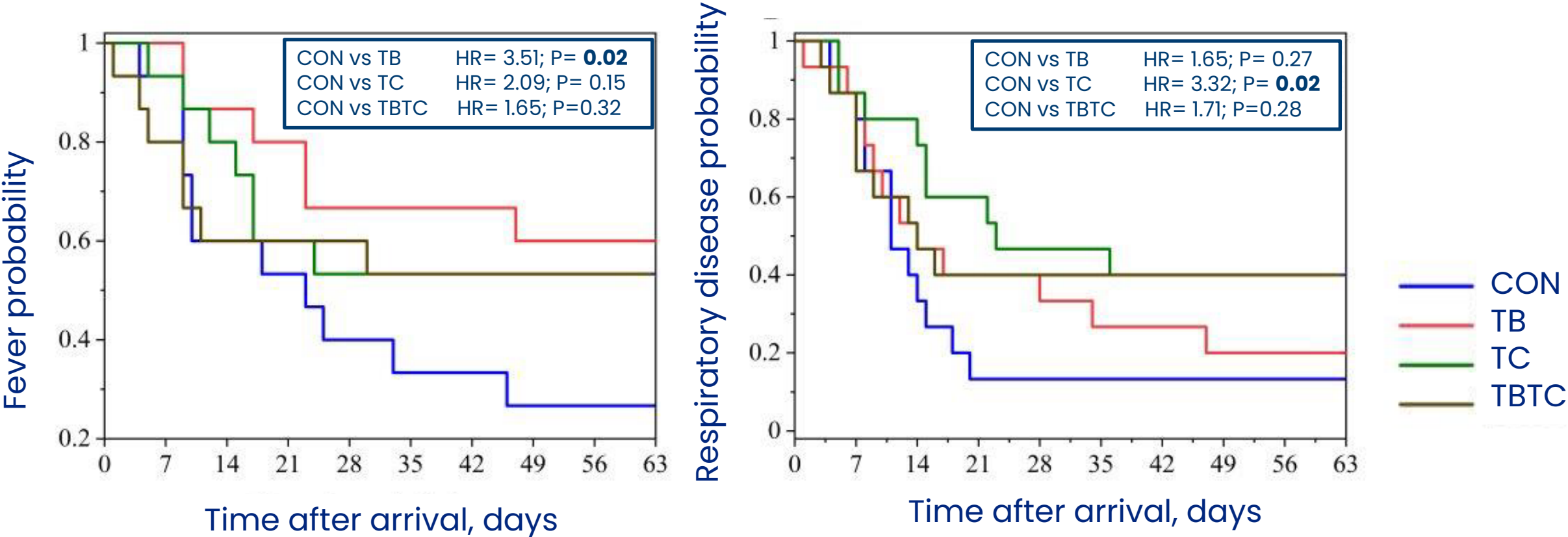
- Common in ruminants
- Avoidance and reluctance to consume unfamiliar food
- Sensory properties of food, such as smell, texture, and taste

Indications of improved health with TB-TC supplementation

Item	Treatment				Pooled SEM	P-value		
	CON	TB	TC	TBTC		TB	TC	TBTC
Calves treated, %								
Fever	73.3	40.0	46.7	46.7	–	0.06	0.13	0.13
Respiratory disease	86.7	80.0	60.0	60.0	–	0.62	0.10	0.09
Other	7.7	13.3	13.3	13.3	–	0.54	0.54	0.54
Therapeutic interventions, n								
Fever	3.5	2.3	2.4	2.5	0.69	0.20	0.25	0.28
Respiratory	1.6	0.5	0.7	1.1	0.31	0.02	0.04	0.23
Other	1.9	1.5	1.4	1.1	0.39	0.55	0.41	0.16
Other	0.1	0.2	0.3	0.3	0.21	0.65	0.37	0.37
Delayed vaccination, %	33.3	6.7	13.3	6.7	–	0.06	0.19	0.06

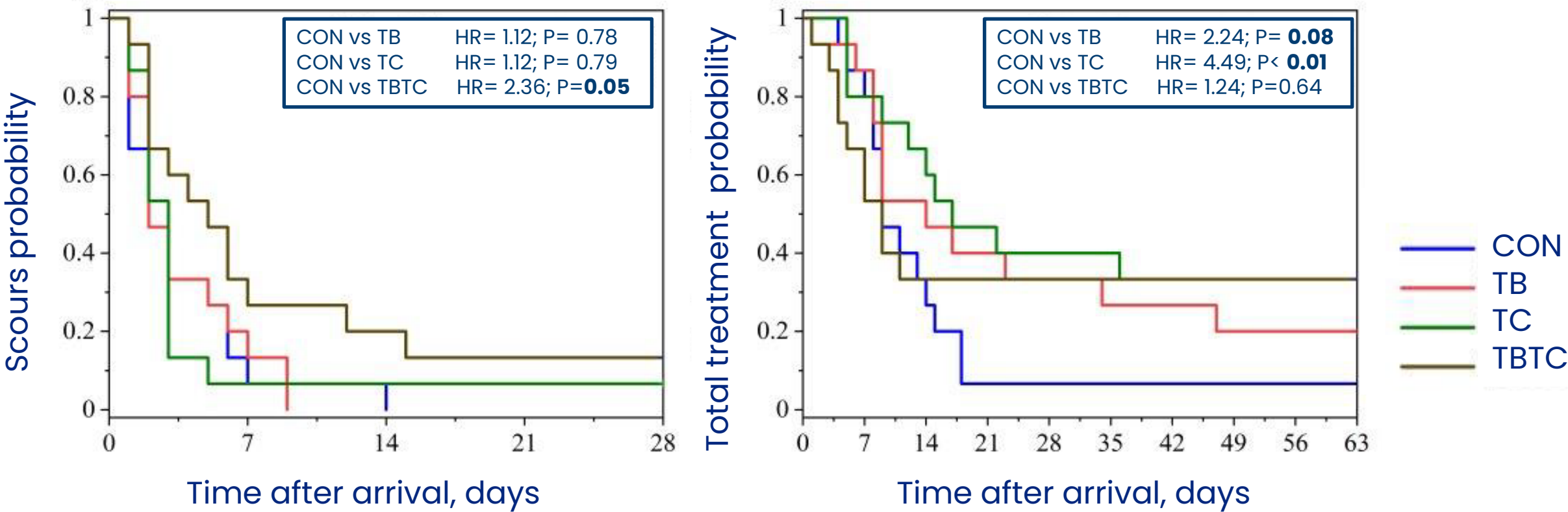
Not vaccinated if body temperature superior to 39.3°C

Non-disease probability – fever and respiratory disease



Control calves had higher chances of being sick

Non-disease probability – scours and total treatments



Control calves had higher chances of needing treatment

Conclusions

The incorporation of TB, TC, and TBTC did not affect growth and intake in restricted-fed calves

Feeding TB and especially TC to calves from 18 days of age onwards adversely affects MR acceptance **(timing of supplementation)**

Calves fed TB, TC, and TBTC required fewer days of therapeutic interventions overall.

Thank you!

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