

Microbiote activity and immunity of horses fed with scFOS and subjected to a vaccination

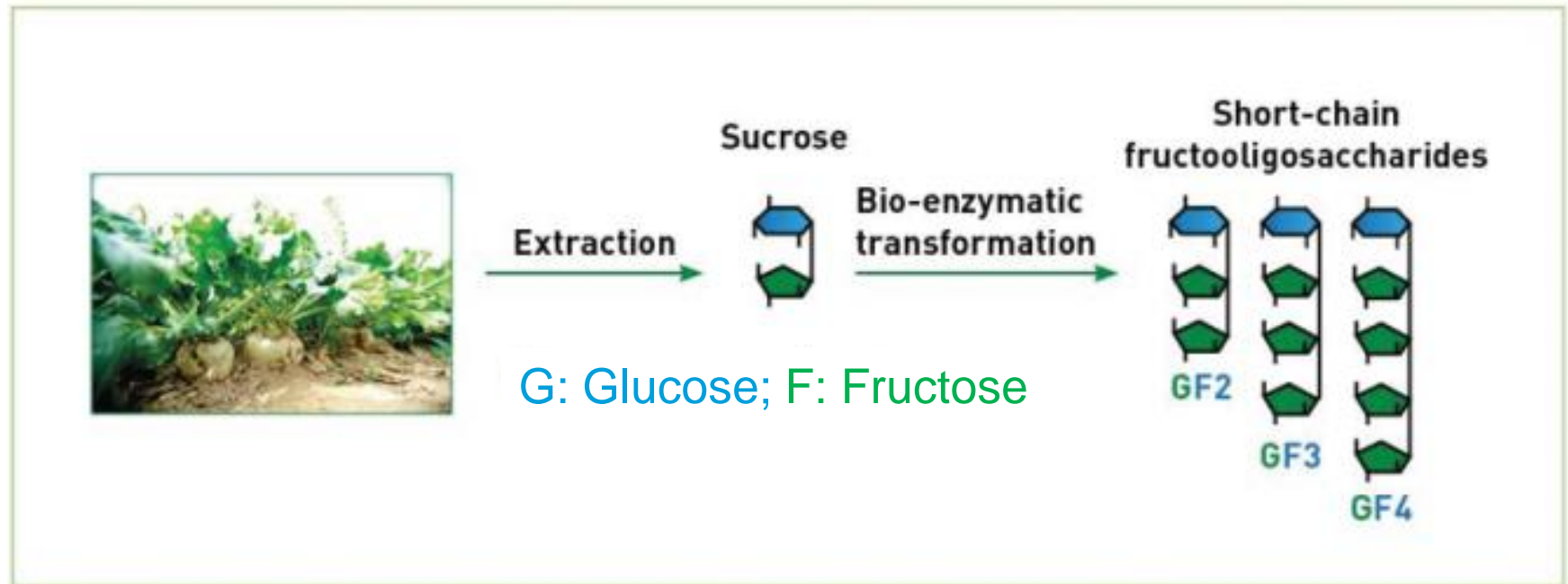
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and V. Julliand



Warsaw, 31th of August 2015

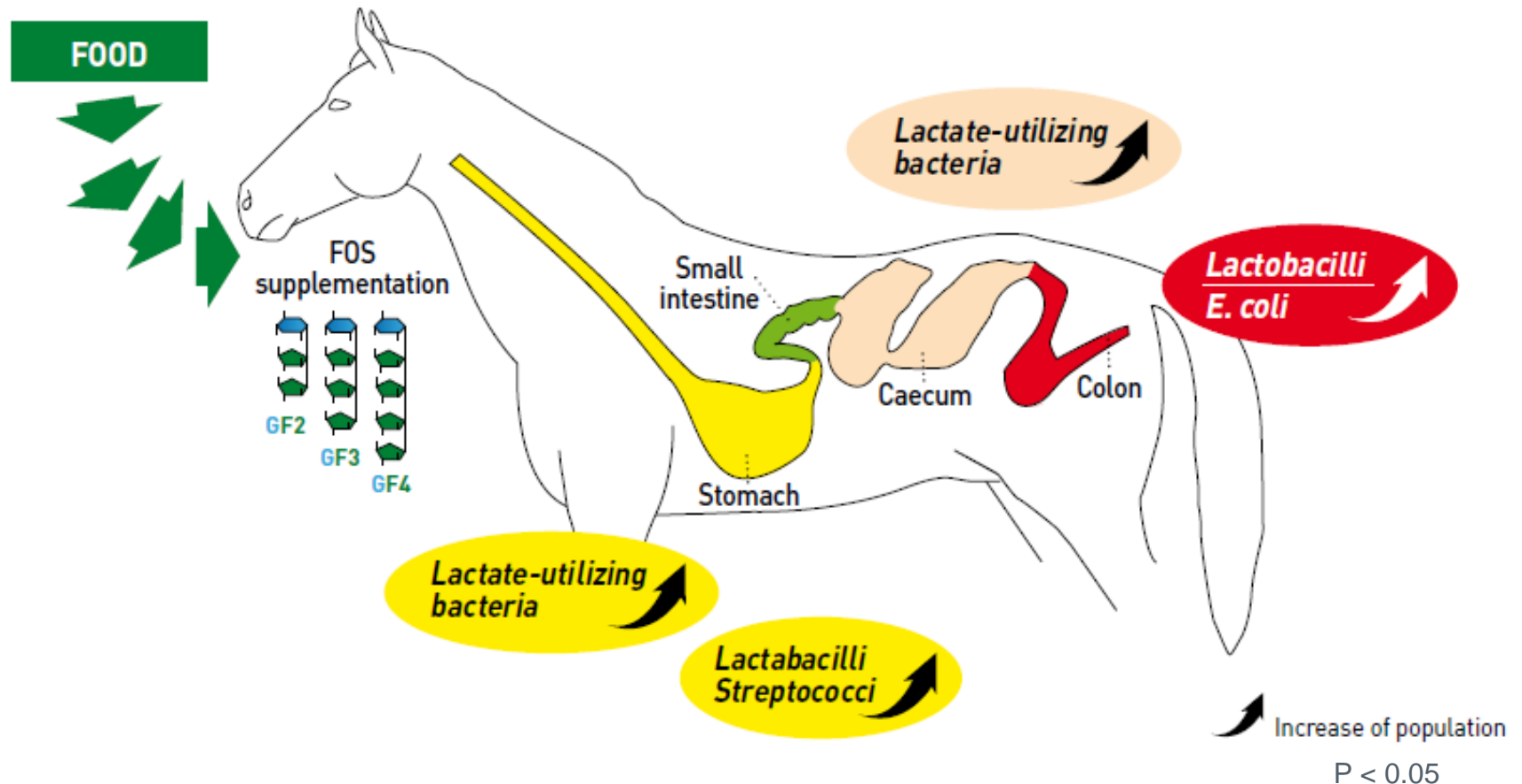
What are short-chain fructooligosaccharides?

- Prebiotic fibres obtained from sugar beet, by a bioenzymatic reaction:

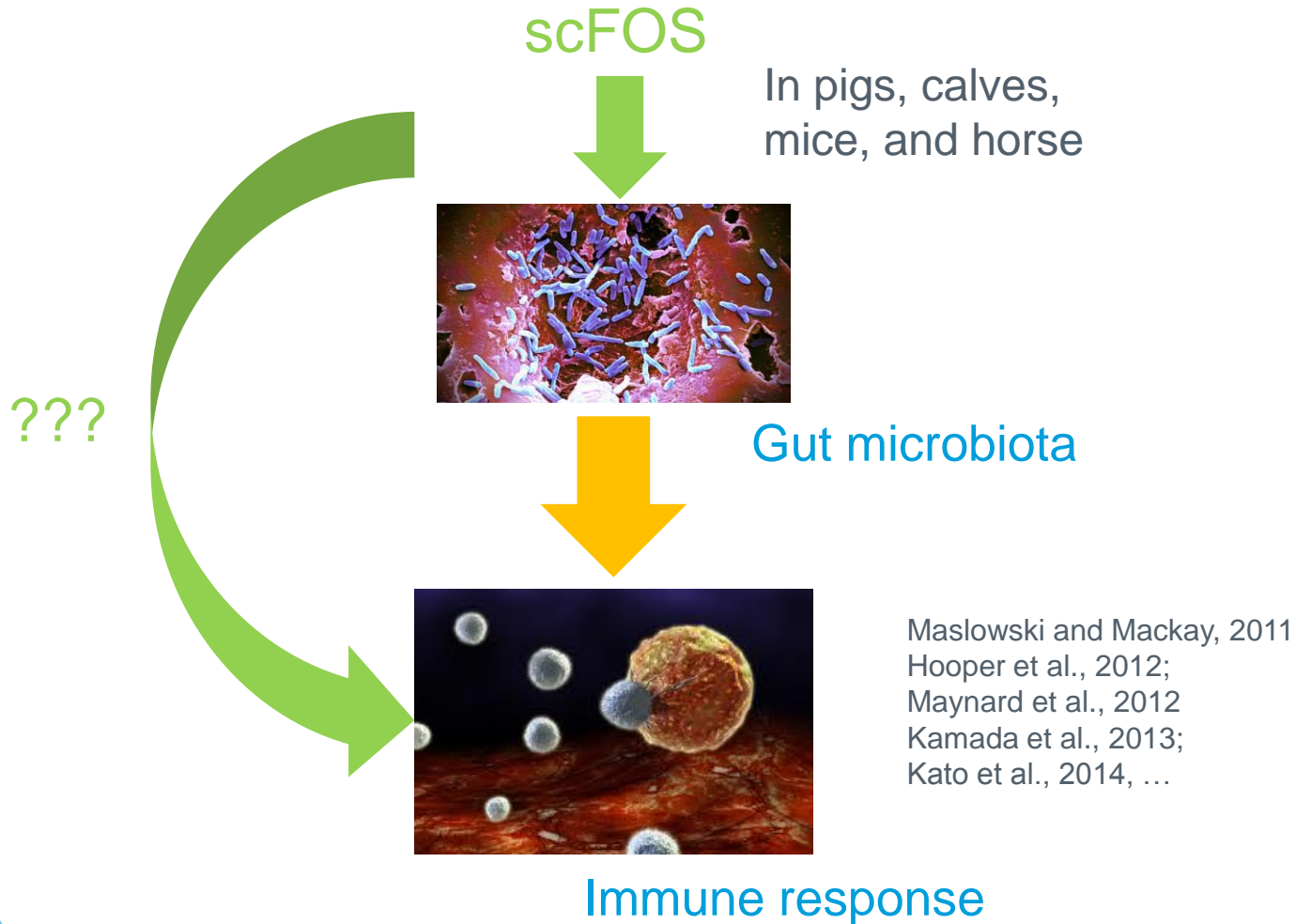


- EU Regulation 68/2013, scFOS = raw material (n° 4.1.14)

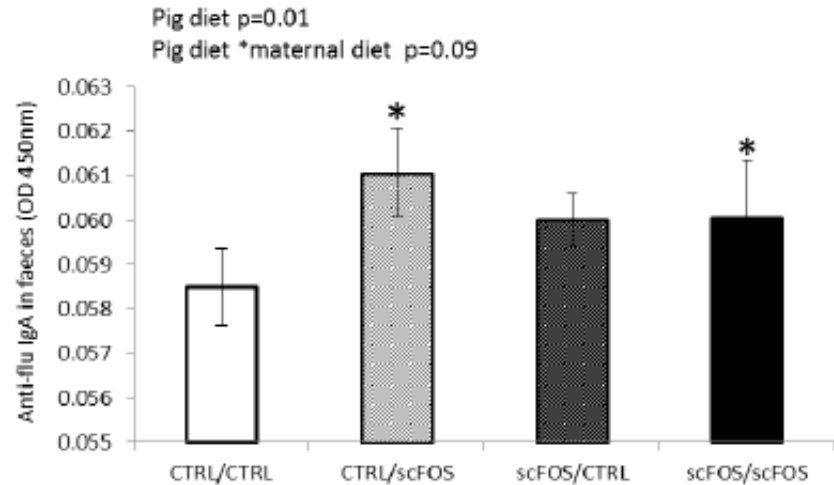
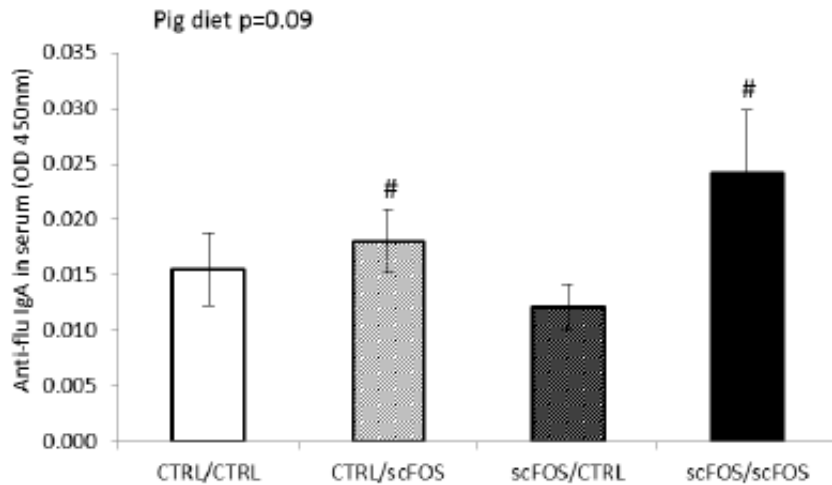
In horses, scFOS modulate microbiota from stomach to colon



Microbiota is known to be involved in mammal's immune response



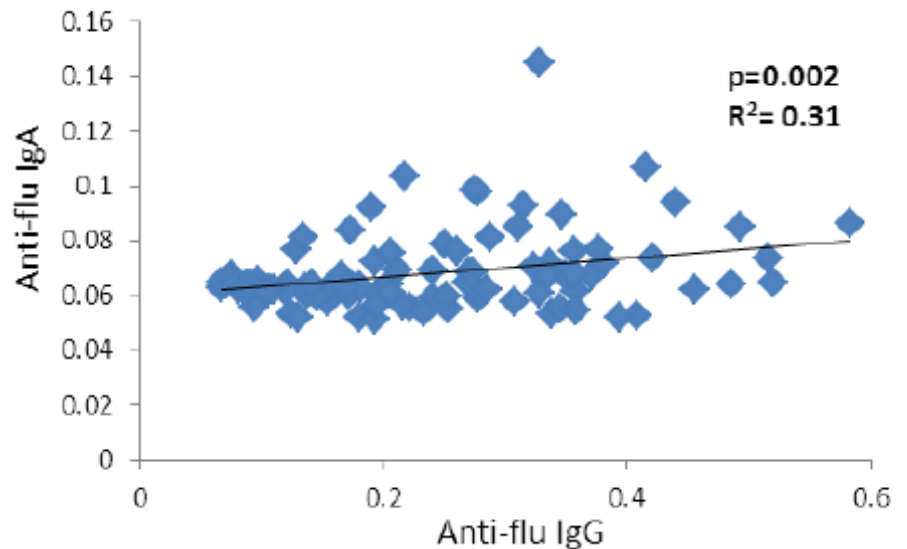
ScFOS modulate immune response after a vaccine challenge in piglets



IgA response to influenza vaccination in serum and faeces

Tendency to be different, $0.05 < p \leq 0.1$.

* Significantly different, $p \leq 0.05$.



Objectives of the study

- **To measure the potential changes of**
 - the intestinal ecosystem activity
 - the immune response**of horses subjected to an EHV1-EHV4 vaccination and fed or not with scFOS**

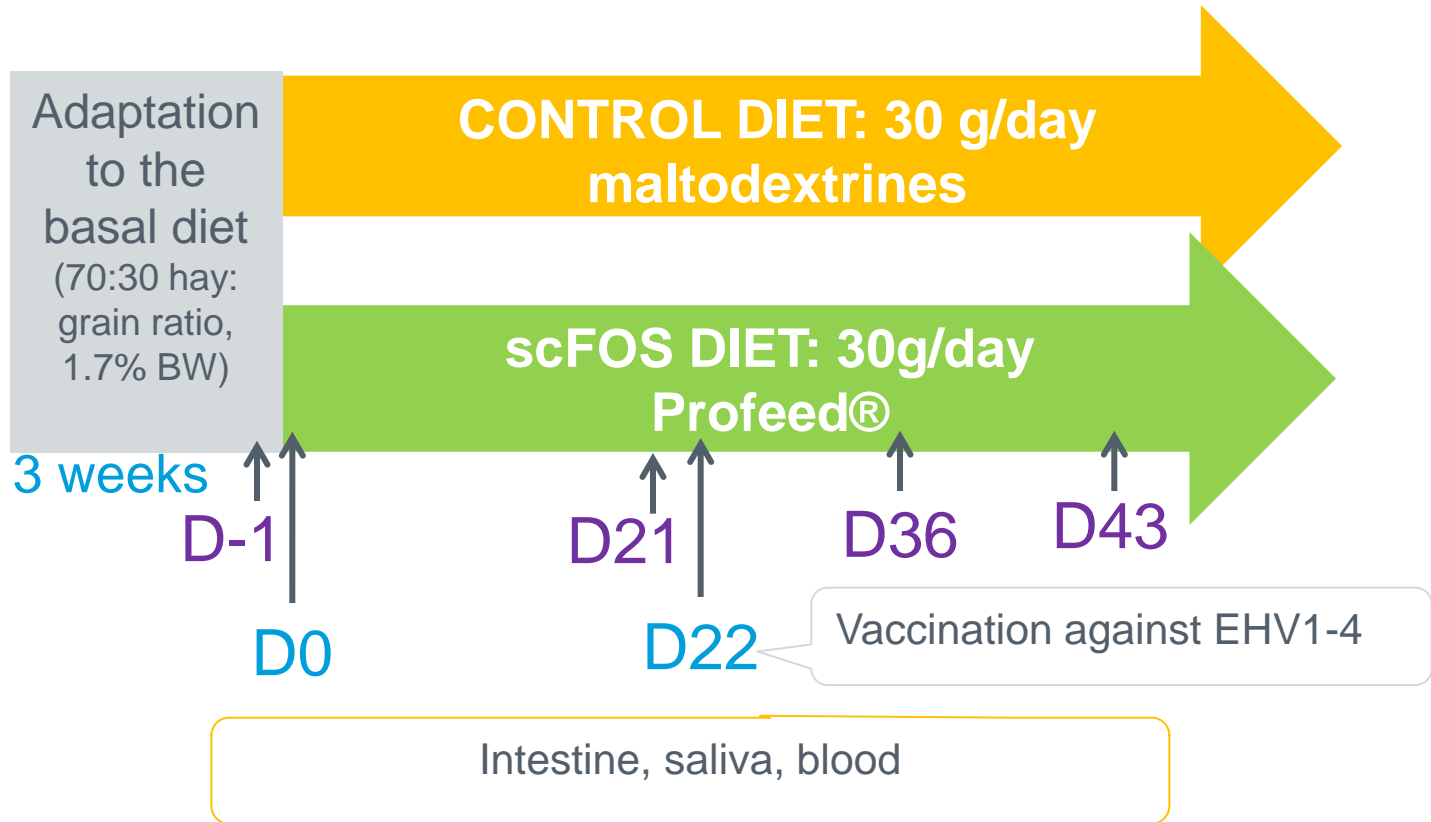
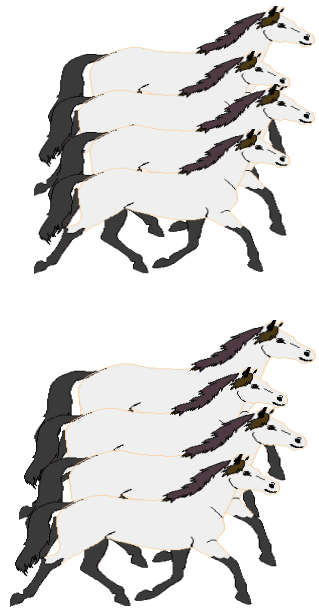
- **To establish potential correlations between local and systemic parameters**

Horses and horse management

- Trial conducted in horse facility d'AgroSup Dijon
- 8 crossbred gelding
 - 12.9 ± 3.3 years
 - BW: 487 ± 33 kg
 - Body condition score: 3.4
 - Cannulas in the caecum and right ventral colon
- Individual free-stalls (13.3 m^2 , wood shavings)
- Exercise
 - 1 hour/day (except on days of measurements)



Experimental design

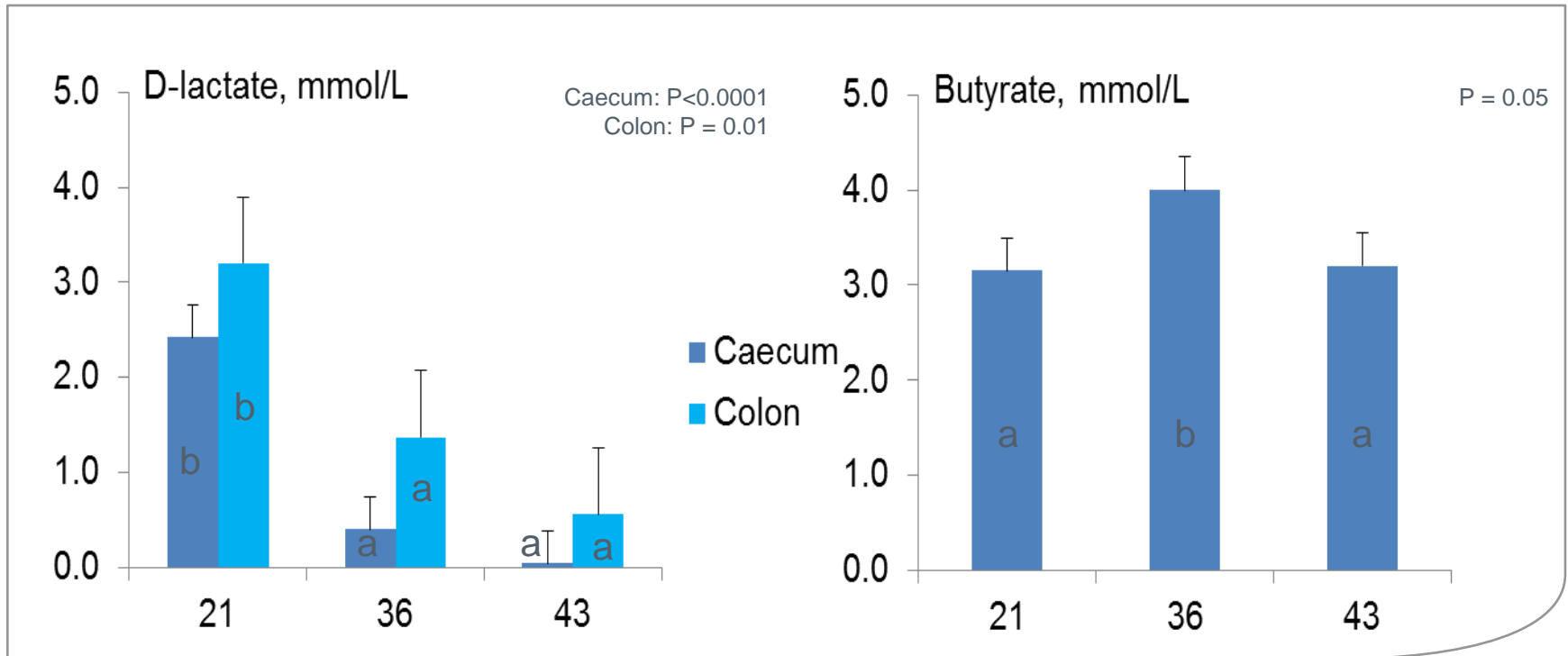


Measures and analysis

- **Caecal and colonic pH and VFA**
- **tIgA in serum, saliva, intestinal filtrates**
- **Blood immune cells, specific Ig**

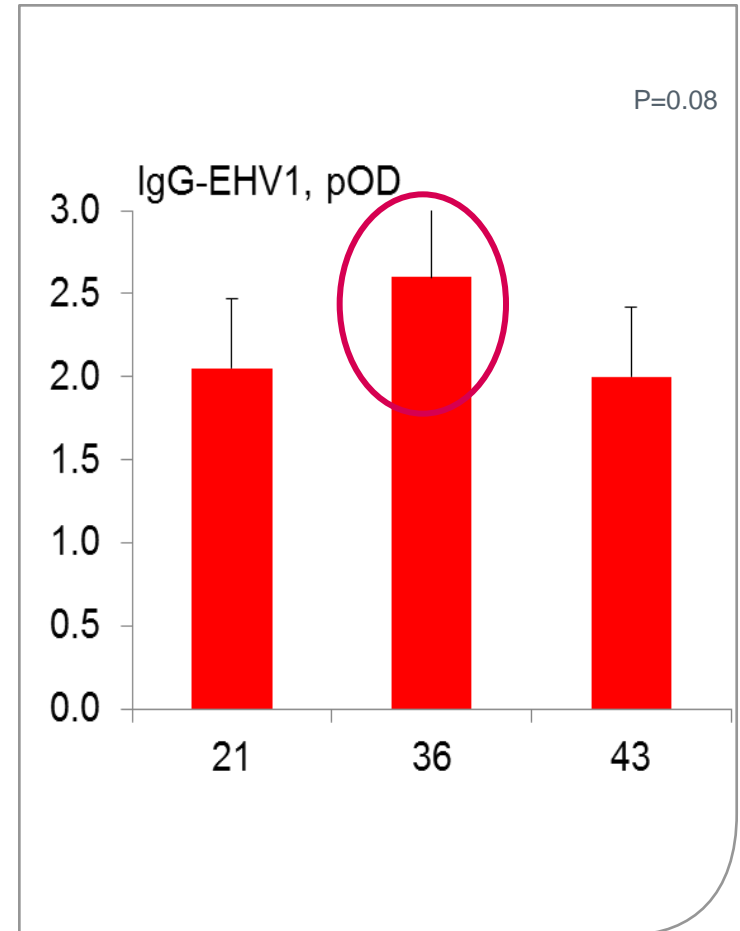
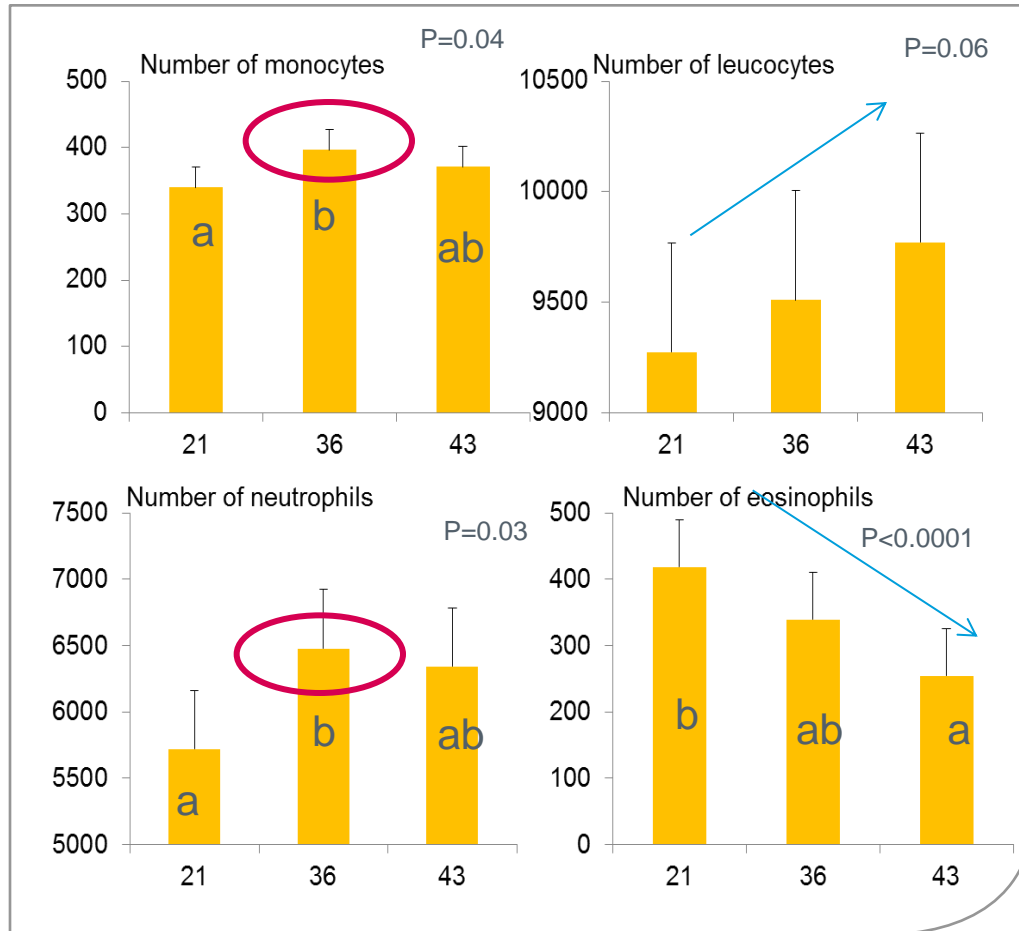
- **Statistical analysis:**
 - ANCOVA:
 - D-1 as covariable, Treatment and day effect + their interaction as fixed factor, Horse: randomized effect
 - PCA for D-1, D21, D36 and D43

1. Vaccination: changing digestive parameters



- Vaccination and immune response result in modifying fermentative orientations in horses: new observation

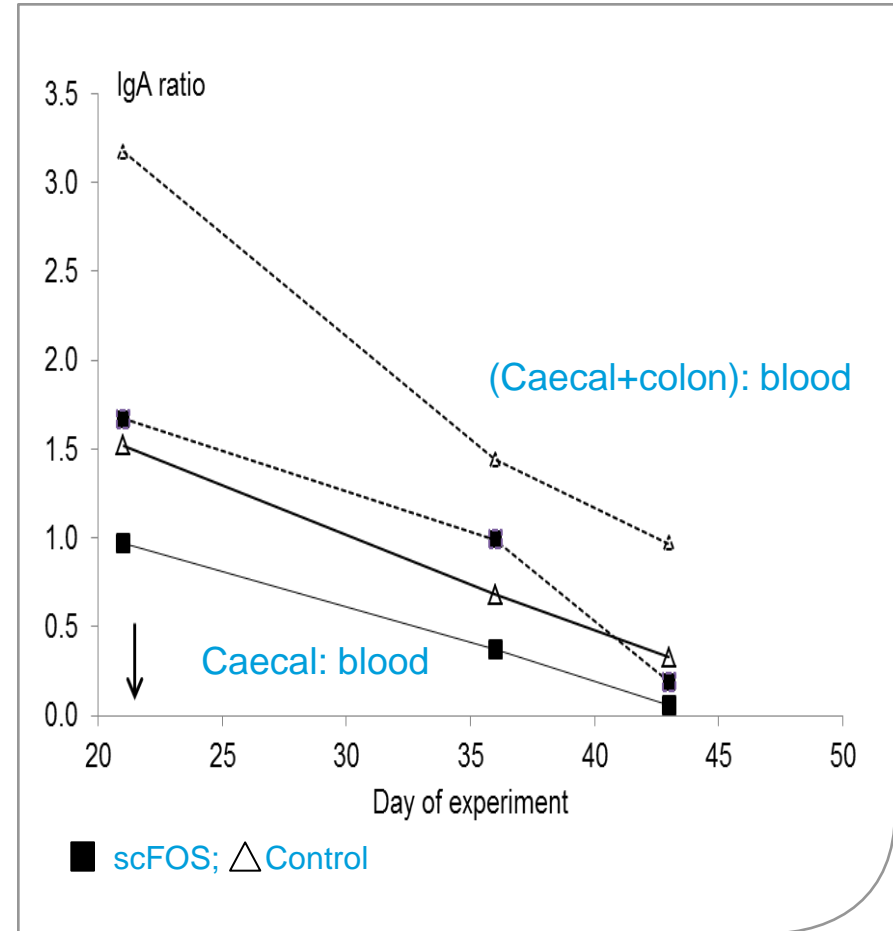
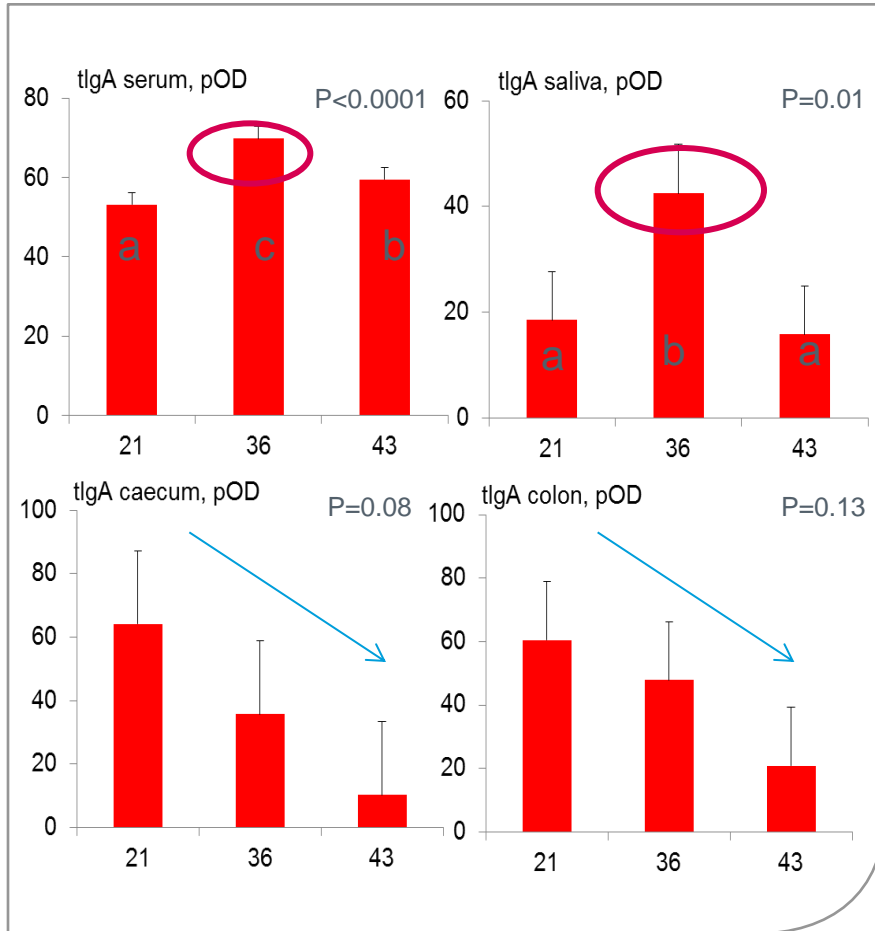
1. Vaccination: changing innate and specific immune response within 2 weeks



Consistent with
Goundasheva et al., 2005

Rather weak
specific response

1. Vaccination: changing local immune response...

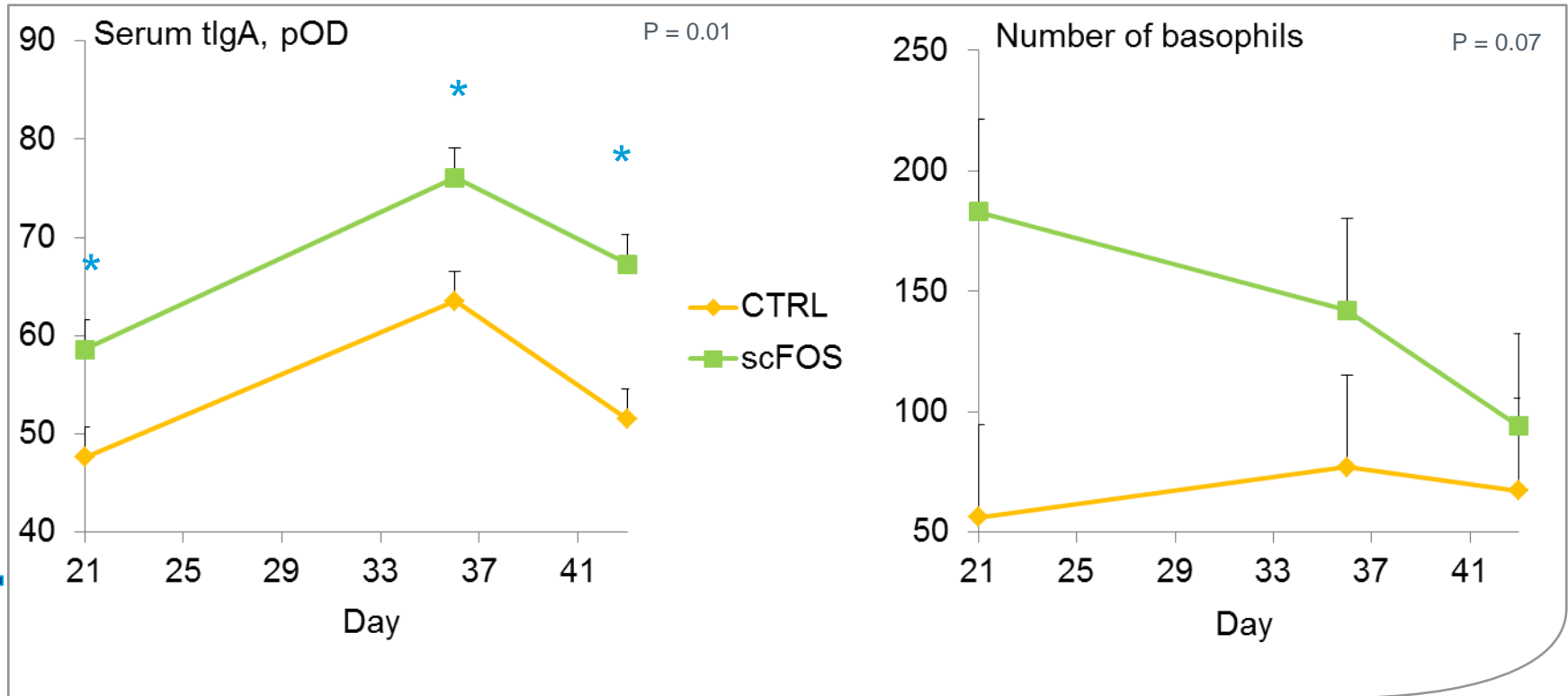


2. scFOS: no modulation of intestine ecosystem activity and immune parameters

No effect on ecosystem activity: $P > 0.05$ for VFA and pH in caecum and colon (data not shown).

Treatment	Control			scFOS			P values	
Day	21	36	43	21	36	43	SEM	scFOS
tlgA-Saliva (pOD)	14.5	42.8	16.1	22.5	42.2	15.5	9.19	0.81
tlgA-Caecum (pOD)	72.2	43.0	17.0	56.0	28.3	4.2	23.1	0.48
tlgA-Colon (pOD)	78.7	48.2	32.8	42.1	47.4	8.8	18.5	0.23

2. scFOS: increasing serum tIgA

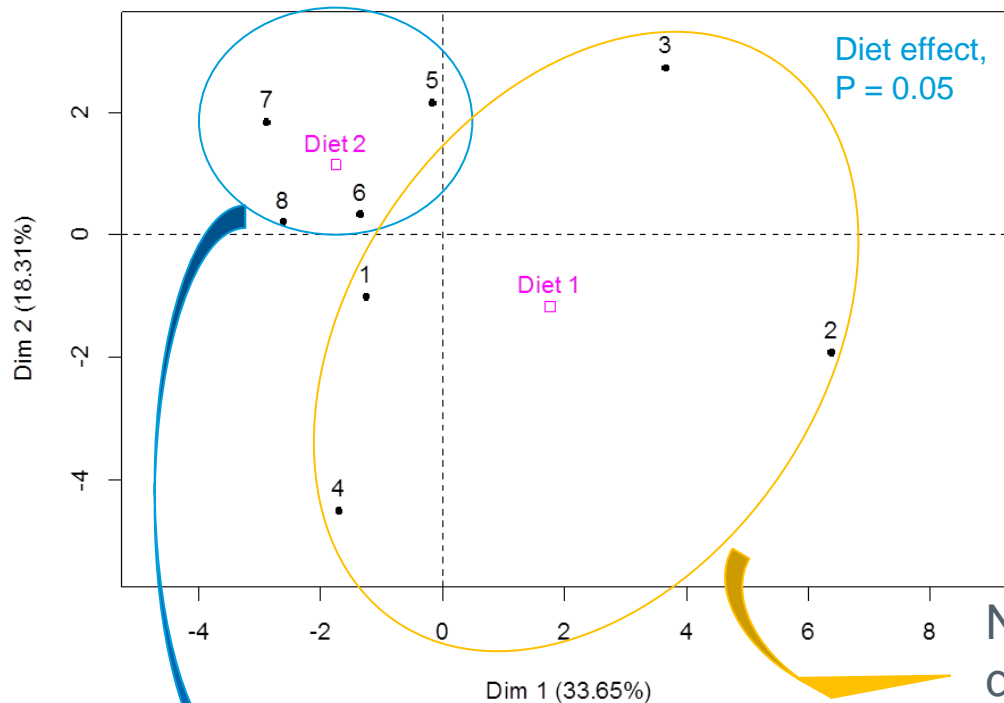


In agreement with studies using mice, humans, calves (Pierre et al., 1997; Manhart et al., 2003; Tai et al., 2009)

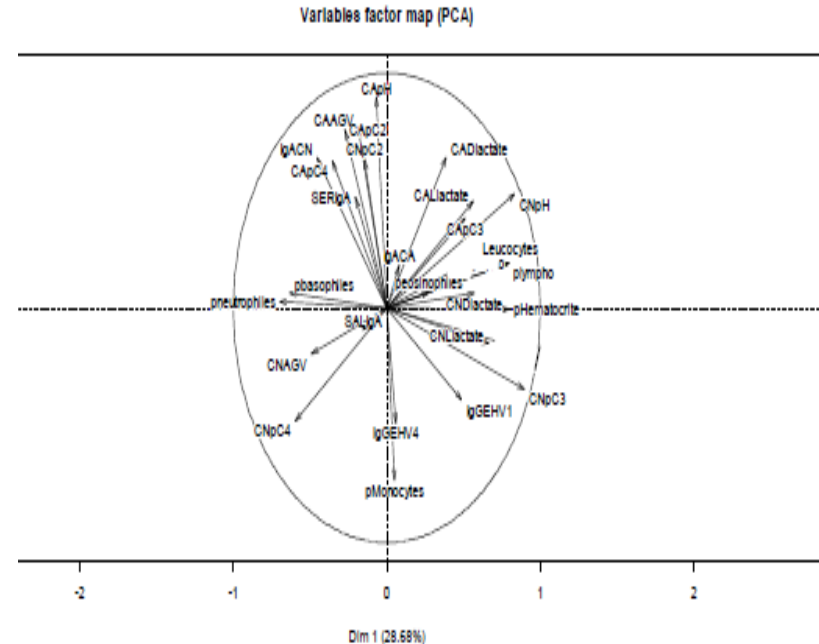
2. scFOS: decreased horse inter-variability before vaccination

No cluster before scFOS supplementation and after vaccination

Individuals factor map (PCA)



Diet effect, P = 0.05



No clear profiles for horses fed control diet

- High concentration of caecal VFA (61.3 ± 7.82 mmol/L)
- High percentage of colonic acetate ($73.0 \pm 1.5\%$)
- High concentration of serum tIgA (55.4 ± 12.5 pOD)



In agreement with Respondek et al., 2008

Conclusions

- **First study in horse to observe simultaneously**
 - local and systemic immune parameters
 - Immune and fermentative parameters
- **Vaccination results in changes of both immune and digestive parameters**
 - Link between microbiota and local/systemic immunity?
 - Fluxes between different parts of the body?

Conclusions

- **scFOS modulate immune parameters of horses notably by increasing tIgA.**
 - In agreement with other studies in other species

- **scFOS reduce inter-variability between horses before vaccination but this effect disappears after vaccination**
 - Benefits?
 - Correlations between fermentative and immune parameters?

Thank you for your
attention!

Questions?



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Biochemical composition of hay and pelleted complementary feed, % of DM

	Grass Hay	Pelleted complementary feed
Organic Matter	91.5	93.1
Neutral Detergent Fiber	63.4	48.2
Acid Detergent Fiber	33.4	22.1
Acid Detergent Lignin	3.4	4.1
Crude Protein	7.6	14.0
Starch	ND ⁷	18.0
Fat	ND ⁷	3.5

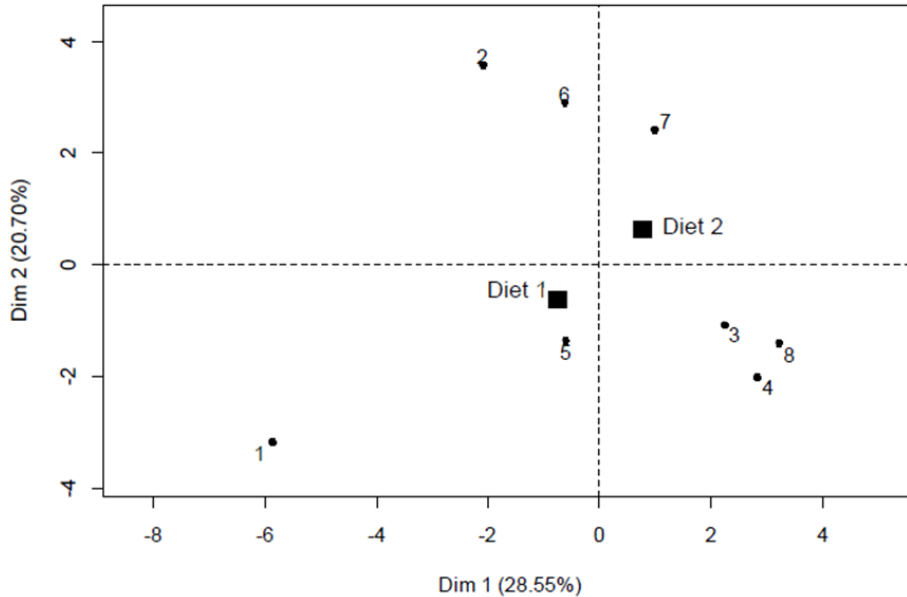
Digestive parameters

Treatment	Control			scFOS			P values ²			
	Day (D) ↓	21	36	43	21	36	43	SEM ¹	T	D
Caecum										
Total VFA	46.5	69.9	50.1	62.7	66.9	53.2	6.08	0.49	0.06	0.12
Acetate	33.5	50.0	35.9	45.7	47.1	36.8	4.50	0.51	0.007	0.08
Propionate	9.9	14.5	10.3	12.7	13.7	11.2	1.57	0.80	0.04	0.38
Butyrate	2.5	3.9	3.0	3.8	4.0	3.4	0.55	0.43	0.05	0.17
pH	6.8	6.6	6.5	6.7	6.6	6.6	0.06	0.59	0.04	0.69
L-lactate	1.42	0.88	0.03	0.34	0.92	0.32	0.687	0.75	0.27	0.35
D-lactate	2.69	0.42	ND	1.92	0.38	0.07	0.346	0.53	<0.00	0.27
Colon										
Total VFA	60.0	62.8	51.6	64.1	60.1	56.5	5.20	0.69	0.25	0.72
Acetate	40.8	42.1	35.1	47.9	42.8	40.3	3.61	0.31	0.16	0.62
Propionate	12.7	14.6	10.6	12.4	13.3	11.5	1.12	0.80	0.06	0.62
Butyrate	4.0	3.7	3.6	3.9	3.4	3.6	0.53	0.76	0.69	0.97
pH	6.9	6.6	6.5	6.6	6.6	6.6	0.10	0.38	0.04	0.05
L-lactate	1.2	1.44	1.04	0.76	1.81	1.75	0.600	0.73	0.61	0.70
D-lactate	3.13	0.36	ND	3.27	2.38	1.11	0.700	0.14	0.01	0.47

This effect was not observed after vaccination

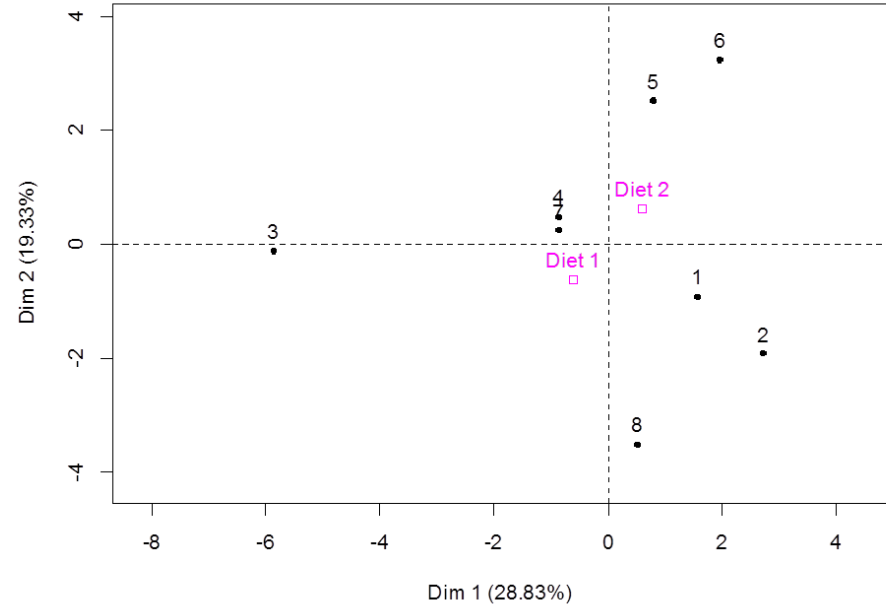
Day 36

Individuals factor map (PCA)



Day 43

Individuals factor map (PCA)



No such cluster on Day 36 and 43:

- Immune response variability?
- Vaccine effect easier to describe than the scFOS effect?