Effect of short-chain fructooligosacharides supplementation on performance and gut health of pigs.

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Introduction

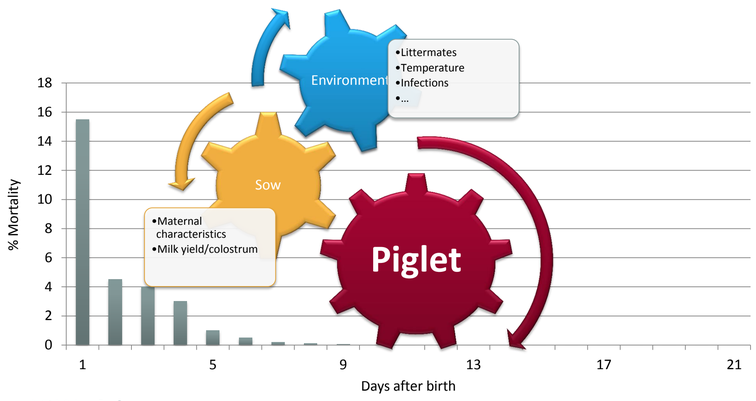
Table 2
Evolution of survival by birth weight (BW) class

BW class	BW range (kg)	Number of piglets: Total born	Born alive	Stillborn	Alive after cross-fostering[a]	Survival, %[b]: at 1 day	at 7 days	at 14 days	at weaning
0.6	<0.61	199	152	47	102	36	16	16	15
0.8	0.61 to 0.80	435	389	46	343	71	51	48	48
1.0	0.81 to 1.00	949	883	66	815	85	75	73	71
1.2	1.01 to 1.20	1643	1549	94	1468	91	87	86	85
1.4	1.21 to 1.40	2412	2309	103	2213	94	91	90	89
1.6	1.41 to 1.60	2622	2525	97	2470	96	94	93	92
1.8	1.61 to 1.80	2069	2006	63	1979	98	96	95	95
2.0	1.81 to 2.00	1130	1116	14	1097	97	96	95	95
2.2	2.01 to 2.20	418	412	6	410	99	99	98	98
2.4	2.21 to 2.40	127	126	1	126	99	98	96	96
2.6	>2.40	38	37	1	37	100	100	97	97

[a] Piglets born alive minus piglets that died after birth because of crushing, killing by the sow, or euthanasia.
[b] Expressed as a percentage of number alive after cross-fostering.

Quiniou et al. , 2002

Increasing **litter size** leads to
- higher **preweaning mortality**
- higher incidence of **less resilient low birth weight (LBW) piglets**



LBW piglets
- **have impaired gut functions** and
- risk long-lasting **suboptimal** growth **performance**.

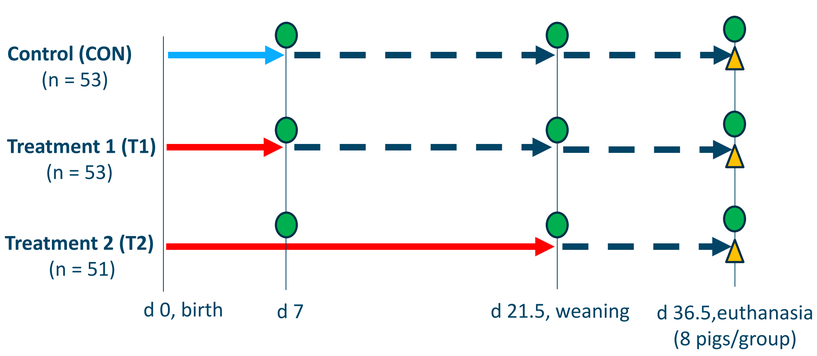
Some pigs show **the ability to compensate** for a LBW
→ Need for a targeted approach.

Short-chain fructooligosaccharides (scFOS), given to the sow improves
- the piglet's gut function,
- the piglet's immune system, and
- the piglet's performance

via
- increased **IgG** content in colostrum,
- a shift in the maternal **microbiome**,
- an improved piglet's intestinal **morphology** and gene expression.

What is the effect of direct supplementation of scFOS to piglets?

Experimental set-up



Intervention (field trial)(n=number of animals included in the groups)
- No intervention (▬ ▬ ▶)
- Sham drenching (2 mL lukewarm tap water)(▬▶)
- Daily supplementation (drenching) of 1 g scFOS (Tereos)(▬▶)

Measurements/samples
- Average daily gain, mortality, overall health (daily)
- Faecal samples (●)(microbiome – NGS, short chain fatty acids (SCFAs))
- Digesta (▲) (SCFA's)
- Intestinal samples (▲) (Ussing chamber, morphology)(SI: small intestine, C: large intestine)

Mixed modelling (different superscript letters indicate differences $p<0.05$)(means ± SE)

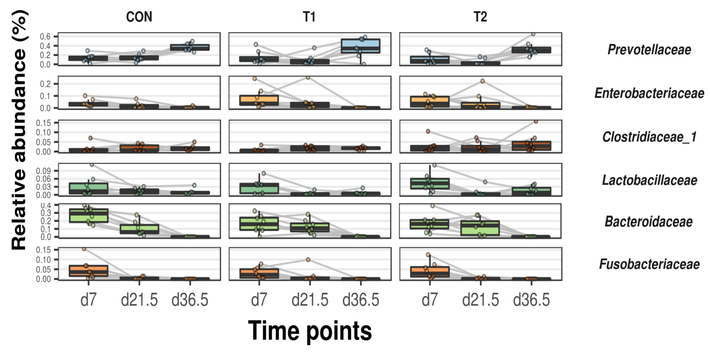
Results

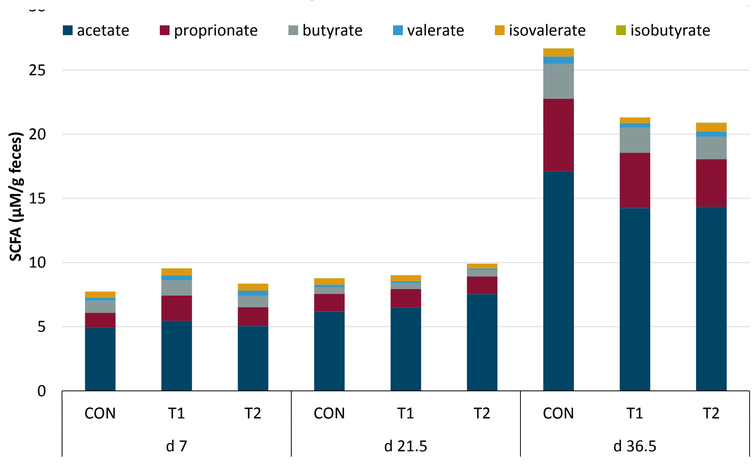
Growth performance and mortality

PERFORMANCE	CON	T1	T2
Item	Mean ± SE	Mean ± SE	Mean ± SE
BW, kg			
d 0 (n)	1.36 ± 0.04 (53)	1.34 ± 0.03 (53)	1.38 ± 0.04 (51)
d 1 (n)	1.44 ± 0.04 (53)	1.41 ± 0.04 (50)	1.44 ± 0.04 (51)
d 2 (n)	1.54 ± 0.04 (53)	1.50 ± 0.04 (49)	1.53 ± 0.04 (51)
d 7 (n)	2.27 ± 0.09 (50)	2.14 ± 0.07 (46)	2.34 ± 0.08 (48)
d 21.5 (weaning) (n)	5.45 ± 0.25 (44)	5.33 ± 0.18 (42)	5.86 ± 0.17 (46)
d 36.5 (post-weaning) (n)	8.29 ± 0.24 (38)	7.80 ± 0.22 (41)	8.16 ± 0.25 (46)
ADG, g/d			
d 0 to d 7	128.2 ± 9.4	117.0 ± 7.9	135.9 ± 8.8
d 7 to d 21.5	214.7 ± 13.1	219.4 ± 9.6	242.4 ± 8.1
d 0 to d 21.5	189.9 ± 11.6	188.4 ± 8.3	209.6 ± 7.2
d 21.5 to d 36.5	153.7 ± 9.1	152.1 ± 7.2	146.1 ± 10.2
d 0 to d 36.5	184.5 ± 6.2	173.3 ± 5.4	182.2 ± 5.9
Mortality, %			
d 0 to d 7	5.7	13.2	5.8
d 7 to d 21.5	12.0	8.7	4.2
d 0 to d 21.5	17.0	20.8	9.8
d 21.5 to d 36.5	**13.6[a]**	**2.4[b]**	**0.0[b]**
d 0 to d 36.5	**28.3[a]**	**22.6[a,b]**	**9.8[b]**

- No effect on ADG (P = 0.40)
- No effect on BW (P = 0.19)
- **Post-weaning mortality was affected by scFOS (P = 0.0078).**

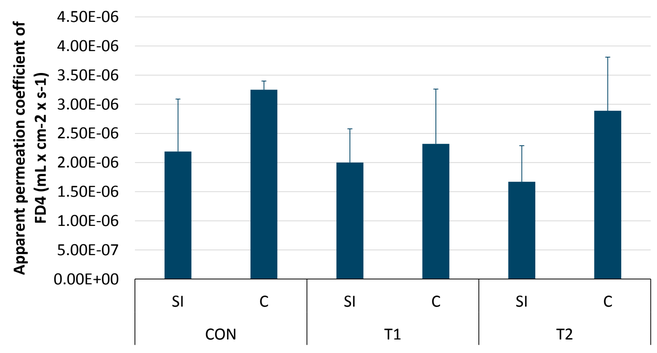
Microbiota and metabolic profile

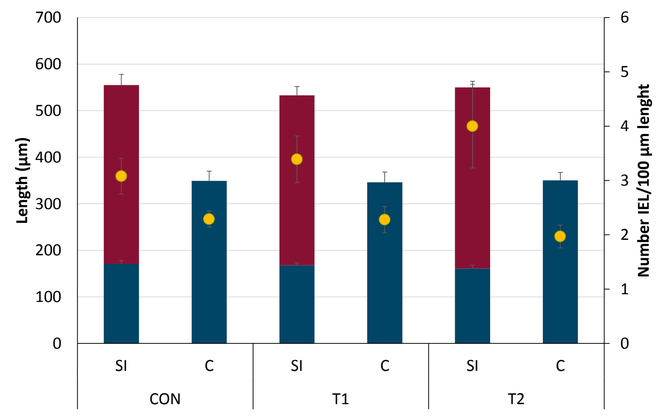




- scFOS treatment had no effect on the relative abundance of several taxa commonly associated with fiber consumption.
- ***Bacteroides*** seems to be temporarily reduced by scFOS supplementation in the first week of life
- ***Alloprevotella*** seems increased in the scFOS treated group.
- The total concentration of SCFAs was unaffected by scFOS (P= 0.22)
- None of the individual SCFAs differed between the treatment groups (acetate P = 0.49; proprionate P = 0.67; butyrate P = 0.32; valerate P = 0.82).

Intestinal permeability and structure





- The Papp of FD4 did not differ between treatment groups (P = 0.96).
- Villus length (red bar) was not affected by scFOS (P = 0.62)
- Crypt depth (blue bar) was not affected by scFOS (P = 0.52)
- The density of intra-epithelial lymfocytes (IELs) (yellow dot) was not affected by scFOS supplementation (P = 0.94)

Conclusion

The supplementation of scFOS to piglets improved their survival but without any overt beneficial effects on gut health. In more detail, no clear difference in the microbiome between the treatment groups were seen. The profile of SCFAs in feces and digesta was unaffected by scFOS supplementation. Intestinal integrity was similar in all treatment groups. Alike, intestinal architecture which was not affected by scFOS supplementation. The density of intra-epithelial lymphocytes was not altered.

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