Impact of diet´s physical form (grinding intensity/compaction) on faecal shedding of E. coli (F4, STI, STII, LTI) after an artificial infection of weaned piglets

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Introduction

Post weaning diarrhea (PWD) caused by *E. coli* is widespread in pig production. It leads to decreased feed intake, reduced body weight gains and mortality rates up to 25%. It is well known that reduced protein and increased levels of dietary fibre have prophylactic effects on the course of an infection caused by *E. coli*.

Based on the well known positive dietary effects of grinding intensity and compaction regarding porcine salmonella infections [1, 2] it was the aim of this study to evaluate whether grinding intensity can influence the extend and severity (the outcome) of an artificial infection with *E. coli* in a comparable way.

Furthermore a possible effect of compaction (pelleting) and in special of thermal treatment (extrusion) was of particular interest for this study.

Material and Methods

Animals and diets:

- three trials
- a total of 57 weaned piglets (8 - 10 per group; 7.4 1.43 kg)
- individually stabled (without litter)
- fed ad libitum (offered once in the morning)
- diets (botanically identical, differing in grinding intensity and/or compaction):
  - coarsely ground meal (CM/CM*)
  - finely ground and pelleted (FP)
  - coarsely ground and pelleted (CP/CP*)
  - coarsely ground and extruded diet (CE)




Parameters of interest:

- daily feed intake of every piglet
- faecal quality (visually)

Artificial infection:

- feeding the different diets for 20 days
- artificial infection on day 21of trial
- infected orally with a diarrhoea causing *E. coli* (F4, STI, STII, LTI) with feed
- faecal shedding from first to sixth day post infection (dpi)
- development of faecal dry matter content (dm)
- evaluation of excretion rate of E. coli (serial dilution; differentiated via PCR)

Nutrient solutions:

- *Brain Heart Infusion Medium* (cultivation)
- *Columbia Blood Agar* (serial dilution)

Analysis of diets

- Particle size analysis of the diets (wet sieve analysis)
- geometric mean diameter (GMD), calculated according to [3].

Results

The piglets fed a finely ground diet had a more pronounced drop in faecal dry matter content as well as their faeces were less formed for a longer period of time than in all other feeding groups. Same - even though not significant - was seen in faecal shedding of applied E. coli (6th dpi: FP > 2.00 log CFU/g faeces; other groups < 2.00 log CFU/g faeces).

Fig 1: faecal score

1=solid, formed;
2=mellow, formed;
3=mellow, unformed;
4=skilly;
5=watery

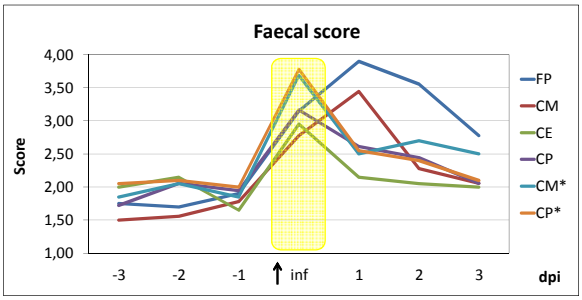
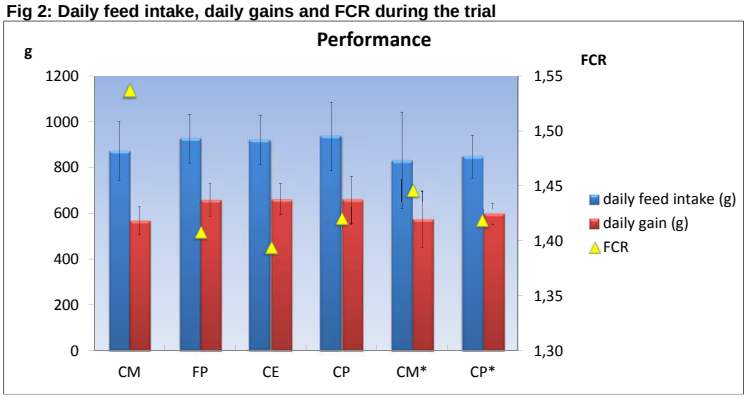


Table 1: Results of the three trials (artificial infection of weaned piglets)

	main aspect	diet s structure		compaction		thermal treatment	
		FP	CM	CP*	CM*	CP	CE
dpi	GMD (µm)	162	789	547	914	631	466
1st	faecal dm (g/kg)	211[a] 38.8	261[b] 13.4	225[a] 53.1	231[a] 41.4	247[a] 29.7	276[a] 33.2
	dm < 20 % (n)	4 / 9	0 / 9	2 / 10	2 / 10	2 / 9	0 / 10
2nd	shedding of applied *E. coli*						
	- n / n	9 / 9	9 / 9	10 / 10	10 / 10	9 / 9	10 / 10
	- log CFU/g faeces**	6.60[a] 1.42	6.66[a] 1.76	5.81[a] 0.77	5.56[a] 1.95	4.99[a] 1.53	4.46[a] 1.67
6th	faecal dm (g/kg)	283[a] 27.3	252[a] 13.7	266[a] 24.1	240[a] 28.7	286[a] 17.0	284[a] 36.1
	shedding of applied *E. coli*						
	- n / n	3 / 9	0 / 9	3 / 10	1 / 10	2 / 9	3 / 10
	- log CFU/g faeces**	2.08[a] 1.85	1.00[a] 0.00	1.70[a] 1.18	1.35[a] 1.04	1.51[a] 0.98	1.70[a] 1.18

*diet inserted in trial three, same grinding as CM/CP
**no detection = half detection limit (1.00 log);
Statistical analyses: SAS software: a, b indicate significant differences (p < 0.05) within one trial

Fig 2: Daily feed intake, daily gains and FCR during the trial



Conclusion

It seems that a coarse structure/physical form of the diet could moderate the faecal shedding of the applied *E. coli*. The duration of shedding seems to be lowered by diet`s physical form (coarse:↓) and a lower number of animals that excrete the pathogen can reduce the risk of reinfection in the group.

Thermal treatment (extrusion) did not influence the outcome of the artificial infection. In both trials coarse meal diet resulted in lower feed intake followed by lower daily gains.

Literature

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