Effect of purified cellulose and pectins on digesta passage rate in growing pigs

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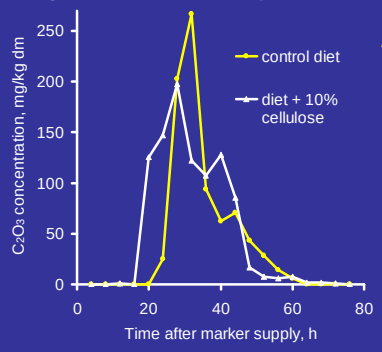
1) Aim

The effects of pure cellulose (slowly fermentable insoluble dietary fibre - IDF) and pectins (quickly fermentable soluble dietary fibre – SDF) on physical-chemical properties of pig faeces and on flow of digesta through the gut were compared.

2) Material and methods

- Six pigs of 33±2 kg were housed in metabolic cages according to two 3x3 latin square designs with periods of 5 weeks.
- A commercial feed was supplied with 0, 5 and 10% of pure cotton cellulose or apples pectins.
- IDF and SDF of diets ranged from 14.9 to 23.3% and from 1.2 to 7.2% of dry matter intake (DMI).
- Digestibility of nutrients was assessed by total faecal collection.
- Faecal samples were scored for their firmness in 6 classes and were analysed for volatile fatty acid (VFA).
- A pulse dose of 5 g of Cr_2O_3 was supplied to each pig, faeces were collected for 96 hrs. with intervals of 4 hrs.. From the kinetic of excretion (figure 1), the time of first appearance of marker in faeces (τ), the compartment turnover rate (λ) and the total mean retention time (MRT) were estimated.
- Data were subjected to ANOVA for the effects of period, pig and, the % of increase of IDF and SDF on DMI as covariates.

Figure 1. Patterns of Cr_2O_3 excretion



3) Results (table 1)

- Dry matter apparent digestibility of the cotton cellulose and apple pectins averaged 7.7±7.7 and 98.2±2.0 %, respectively.
- The increase of the percentage of IDF on DMI:
  - reduced IDF digestibility but not that of others nutrients;
  - increased the faecal mass mainly because a higher water content;
  - increased the faecal firmness;
  - increased the faecal concentration of VFA with a reduction of acetic acid to propionic acid ratio;
  - reduced MRT due to an increase of λ and a decrease of τ.
- The increase of the percentage of SDF on DMI:
  - did not affect the digestibility of nutrients of basal diet and the physical-chemical properties of faeces;
  - reduced the amount of urinary water;
  - did not influence MRT for the opposite effects on λ and τ.

4) Conclusions

- The use of purified cellulose in growing pigs diets does not affect the digestion of others nutrients and, because of its bulk, increases the digesta flow rate. A shift in the site of digesta fermentation can explain the observed changes in faecal VFA concentration.
- Pectins had opposite effects on the parameters of digesta flow rate. The lower amount of urinary water for increasing amounts of pectins may reflects some osmotic effects due to a reduction of the peak of nutrient absorption.

Table 1. Feed intake, digestibility of nutrients, water excretions, physical-chemical characteristics of faeces and digesta passage rate parameters.

	Overall mean	IDF [1]		SDF [2]		RSD
		Slope	SE	Slope	SE	
Dry matter intake, g/d	2329.4	+26.6	25.8	+14.7	28.0	114.3
Digestibility coefficients %						
- dry matter	84.28	-0.56 *	0.24	+0.21	0.26	1.07
- crude protein	83.04	+0.07	0.25	-0.20	0.27	1.10
- IDF	48.84	-0.76 *	0.10	+0.50	1.08	4.43
- SDF	74.25	-1.31	1.39	+4.28 *	1.51	6.15
Water excretions, g/d						
- faecal water	706	+83 **	10	+3	11	45
- urinary water	2551	-51	91	-236 *	99	403
Faecal properties,						
- mass, g	1072.1	+102.9 **	13.4	-1.6	14.5	59.2
- dm, g	365.9	+19.9 **	3.7	+4.7	4.0	16.2
- firmness, score	2.91	+0.17 **	0.03	-0.03	0.04	0.16
- VFA, µM/kg dm	156.8	+13.6 **	3.0	+1.2	3.3	13.3
- $(C_2+C_4)/C_3$ [3]	3.023	-0.158 **	0.047	+0.111	0.051	0.360
Digesta passage rate:						
- τ, h	27.9	-0.19 **	0.07	-0.65 **	0.08	0.31
- λ, 1/h	0.1774	+0.0109 **	0.0010	-0.0056 **	0.0011	0.005
- MRT, h	40.29	-0.850 **	0.10	+0.001	0.10	0.43

* $P<0.05$; ** $P<0.01$; [1] effect due to the increase of 1% of IDF on dry matter intake; [2] effect due to the increase of 1% of SDF on dry matter intake; [3] (acetic acid + butyric acid) / propionic acid.

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