

## BACKGROUND

The intestinal tract of piglets change during growth and especially in the time around weaning. In this time the piglets have often diarrhea, which produce high costs in breeding. One facility is to give antibiotic with the feed ingredients, but from 2006 on the antibiotics in feed are forbidden in the EU. In this approach two different flavanol rich feeding regimens were applied in young growing piglets (freeze dried apple and red wine pomace). The average of the total polyphenol content in apple is 3 g per kg fresh weight (0.5 – 11 g/kg) and 2 mg/liter red wine.

## GOALS

- Investigation of the effects of polyphenol rich feeding in piglets:
  - in Ileum
  - in Jejunum
  - in Colon
- Test the effect of apple and wine pomace on the activation of Peyer Patches located in the ileum
- Investigate the time course of villi and crypt morphology

## MATERIAL & METHODS

In this study 78 piglets were fed over 4 weeks with three different feeding regimens. 26 animals were fed with normal piglet starter, 26 got additionally 3.5% dry matter (dm) apple pomace and further 26 got additionally 3.5% dm red wine pomace. All piglets were born in the same week. The treatment starts after the 4th live week for a duration of 4 weeks. Animals were killed weekly at five different time points around weaning.

### We measured :

- villi length and breath in the ileum and jejunum
- crypt depth and breath in the colon
- area of the villi and crypt
- peyer patches area in ileum

Each distance was measured in triplicates (n = 234 each) by using a digital camera and axiovision software.

### Mathematical and statistical analyses

Data are presented as means and SEM. For statistical analysis, a two way ANOVA (Sigma Stat) was performed. Differences were considered significant if  $P < 0.05$ .

## RESULTS

The villi area in jejunum increase strongest in the control animals and apple feed animals. No significant growth could be shown in the red wine pomace group. No significant changes could be shown in ileum. In colon the villi and crypt area growth was significantly increased in apple as well in red wine pomace feeding groups. Peyer patches were highly enlarged in control group after 28 days.

### Influence of apple and red wine pomace on gut morphology

Jejunum	control group	apple pomace group	red wine pomace group
villi length	$y=0.004x+0.5108$ 21%	$y=0.0038x+0.5324$ 20%	$y=0.0007x+0.551$ 3.6%
villi breath	$y=0.0013x+0.0965$ 37.7%	$y=0.0004x+0.1064$ 10.5%	$y=0.0004x+0.1062$ 10.5%
villi area	$y=0.0012x+0.047$ 71% ( $p<0.001$ )	$y=0.0007+0.0536$ 36.6% ( $p<0.01$ )	$y=0.0004x+0.0567$ 19.7% (n.s.)

Ileum	control group	apple pomace group	red wine pomace group
villi length	$y=0.0031x+0.4133$ 21%	$y=0.0042x+0.4069$ 29%	$y=0.0043x+0.4167$ 29%
villi breath	$y=-0.0023x+0.1743$ -37%	$y=-0.0023x+0.1709$ -38%	$y=-0.0026x+0.1738$ -42%
villi area	$y=-0.0005x+0.0718$ -19%	$y=-0.0004x+0.0691$ -16%	$y=-0.0005x+0.0714$ -20%

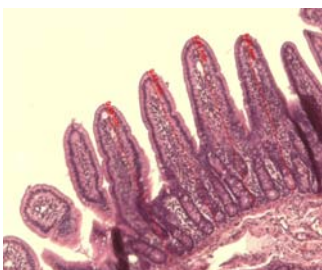
Colon	control group	apple pomace group	red wine pomace group
villi/crypt length	$y=0.0044x+0.3134$ 39%	$y=0.0057x+0.2985$ 53%	$y=0.0049x+0.3016$ 45%
villi/crypt breath	$y=-0.0001x+0.0457$ -6%	$y=0.0003x+0.0371$ 23%	$y=6E-0.5x+0.0417$ -0.03%
villi/crypt area	$y=0.0001x+0.0151$ 19% (n.s.)	$y=0.0004x+0.0109$ 103% ( $p<0.001$ )	$y=0.0002x+0.0126$ 44% ( $p<0.001$ )

### Influence on peyer patches

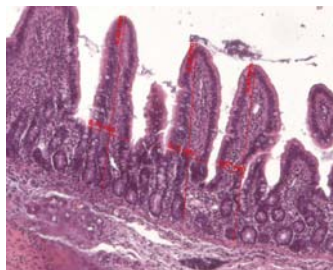
Peyer patch	control group	apple pomace group	red wine pomace group
Peyer patch area	$y=0.0015x+0.204$ 21% ( $p<0.007$ )	$y=9E-0.5x+0.203$ 0% (n.s.)	$y=0.0003x+0.222$ 3.8% (n.s.)

## CONCLUSION

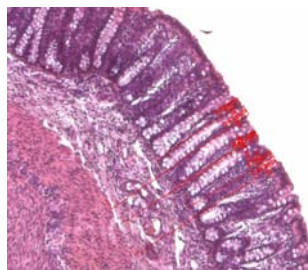
Apple and red wine pomace can reduce the immune system activation via the peyer patches in the ileum. Different feeding regimens have diverse effects in the gastrointestinal tract. Red wine pomace has inhibitory effects in the jejunum villi growth and apple pomace has a stimulating effect on colon villi and crypt growth. **Flavanoid rich feeding regimen showed positive effects on gut health and is a good alternative to improve piglet health in agriculture after the ban on antibiotics.**



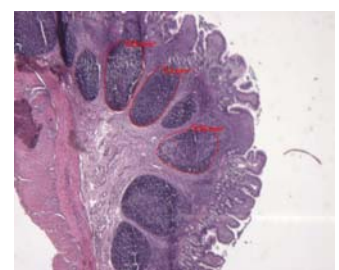
jejunum



ileum



colon



ileal lymph nodes