Protein and amino acid digestibility in white-flowering faba bean and cake from cold-pressed rapeseed, linseed and hempseed in growing pigs

EAAP meeting, Heraklion 2010, session 11

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Background

*Organic animal production* (EC, 1999)

- 100 % organic feed & high self-sufficiency level
- No use of:
  - Industrially produced amino acids
  - Feed ingredients originating from GMO
  - Feed ingredients treated with chemical solvents

*Evaluate potential protein-rich feed resources*

- Limited number of legumes and oil seeds
Background

Faba beans (Vicia faba)

- White flowered varieties is increasingly used in conventional and organic pig feed
- High protein content (~ 30%) - rich in lysine
- Protein and amino acid digestibility comparable with conventional protein feed ingredients

Previous investigations about nutrient value:
van der Poel et al., 1992; Jansman et al., 1993; Mosenthin et al., 1993; Partanen et al., 2001; Mariscal-Landín et al., 2002
Background

**Cold pressed rapeseed cake** (*Brassica napus*)

- Used in organic diets
  - no use of hexane when extracting oil
- High protein content - rich in threonine and sulphur-containing amino acids

Several investigations about rapeseed products but few on cold pressed cake (Schöne et al., 1998; Partanen et al., 2001)

**Cold pressed linseed cake** (*Linum usitatissimum*)

- Used to some extent in organic diets
- High protein content (~ 30%) – poor in lysine

Few investigations on digestibility in pigs. Some studies on piglet gut health (Jansman et al., 2007a;b)
Background

**Hempseed cake** (*Cannabis sativa*)

- Hempseed mainly used for fiber/seed/oil production
- Cold pressed cake - rarely used in conventional and organic animal diets
- Desirable high protein content (30-35%) & amino acid profile – nutrient value for pigs?

Previous investigations about nutrient value (other species than pig):
Hullar et al., 1999; Mustafa et al., 1999; Callaway, 2004; Silversides & Lefrançois, 2005; Hessle et al., 2008
Potential protein feed resources!

Limited available reports/data about protein and amino acid digestibility & efficient use as feed ingredient
Aim

• Descriptive investigation
• Determine the ileal apparent (IAD) and standardized ileal digestibility (SID) of crude protein (CP) and amino acids (AA)
  • in organically cultivated white-flowering faba beans, and cakes from hempseed, linseed and rapeseed
What/how did we do?

- Four period change-over trial with six castrated male Yorkshire pigs (22.1 kg BW)
- Surgically provided with post valve T-caecum cannulas (PVTC) (van Leeuwen et al., 1991)
- Individually housed
What/how did we do?

Dietary treatments:

*Treatment diets* (HC, LC, RC, F)

Experimental feed ingredients, 25-30% inclusion level
Basal feed (cornstarch, sugar, casein, premix, TiO$_2$)
Crude protein content: 170 g kg$^{-1}$ DM

*Casein diet* (CAS) – pre and post treatment periods
protein source: casein - to determine endogenous N & AA secretions (Høøk Presto et al., 2010)

Diets were nutritionally balanced, fed twice a day
- 4% of individual live weight until 60 kg
- 2.4 kg / pig and day after 60 kg (4% of 60 kg)
What/how did we do?

• Each experimental period 14 days
  7 days adaptation
  Faeces – sampling at days 8-11
  Ileal digesta – sampling at days 12 and 14
• 1-hour periods evenly distributed between morning and afternoon meal (8.30 am – 4.30 pm)

• TiO₂ indigestible marker for calculations of digestibility and endogenous losses of N and AA in ileal digesta
• IAD of CP and AA for protein feed ingredients
  • Corrected and accounted for contribution of casein
• SID values - corrected for basal ileal secretions of endogenous N and AA
Results

Diets:
IAD and TTAD of crude protein – no treatment effect
  \( p=0.074 \) and \( 0.277 \)
IAD of amino acids – treatment effects for most AA
  • in general lower IAD for RC diet

Feed ingredients:
IAD of and SID of crude protein – treatment effect
  \( p=0.029 \) and \( 0.047 \). Lower Dig. values for rapeseed cake
IAD and SID of amino acids – treatment effects for most AA
  • No specific direction
Ileal apparent and standardized digestibility (%) for feed ingredients

Hempseed cake

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0  20  40  60  80  100

12
Ileal apparent and standardized digestibility (%) for feed ingredients

Linseed cake

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IAD | SID
Ileal apparent and standardized digestibility (%) for feed ingredients

Rapeseed cake

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0 20 40 60 80 100

CP, Lys, Thre, Met, Isoleu, Leu, Phe, Val, Arg, His

IAD, SID
Ileal apparent and standardized digestibility (%) for feed ingredients

Faba bean

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Conclusions

• The results make an useful contribution to a more efficient use of alternative protein feed ingredients
• Satisfactory digestibility of CP and AA
  • Comparable with conventional protein feed ingredients
• Investigated feed ingredients - suitable to be used in pig diets
• Additional data on nutrient value and efficient use is desirable
Thank you for your attention!

Thanks to:

**Formas**
(Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning)

Dept. of Animal Nutrition and Management, SLU
Dept. of Clinical Sciences, SLU