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

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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

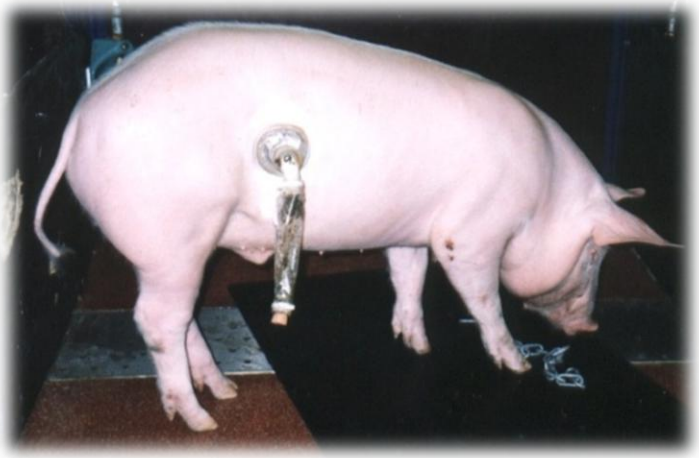

Potential protein feed resources!
Limited available reports/data about protein and amino acid digestibility & efficient use as feed ingredient

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

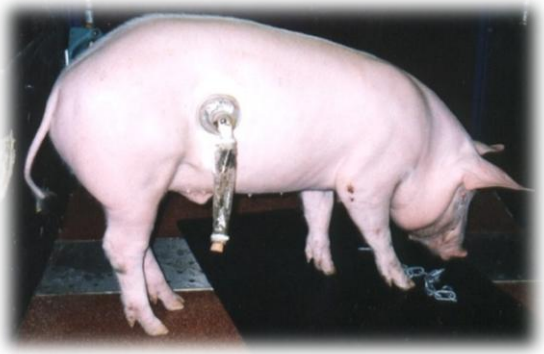
Casein diet (CAS) – pre and post treatment periods

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)
- TiO_2 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

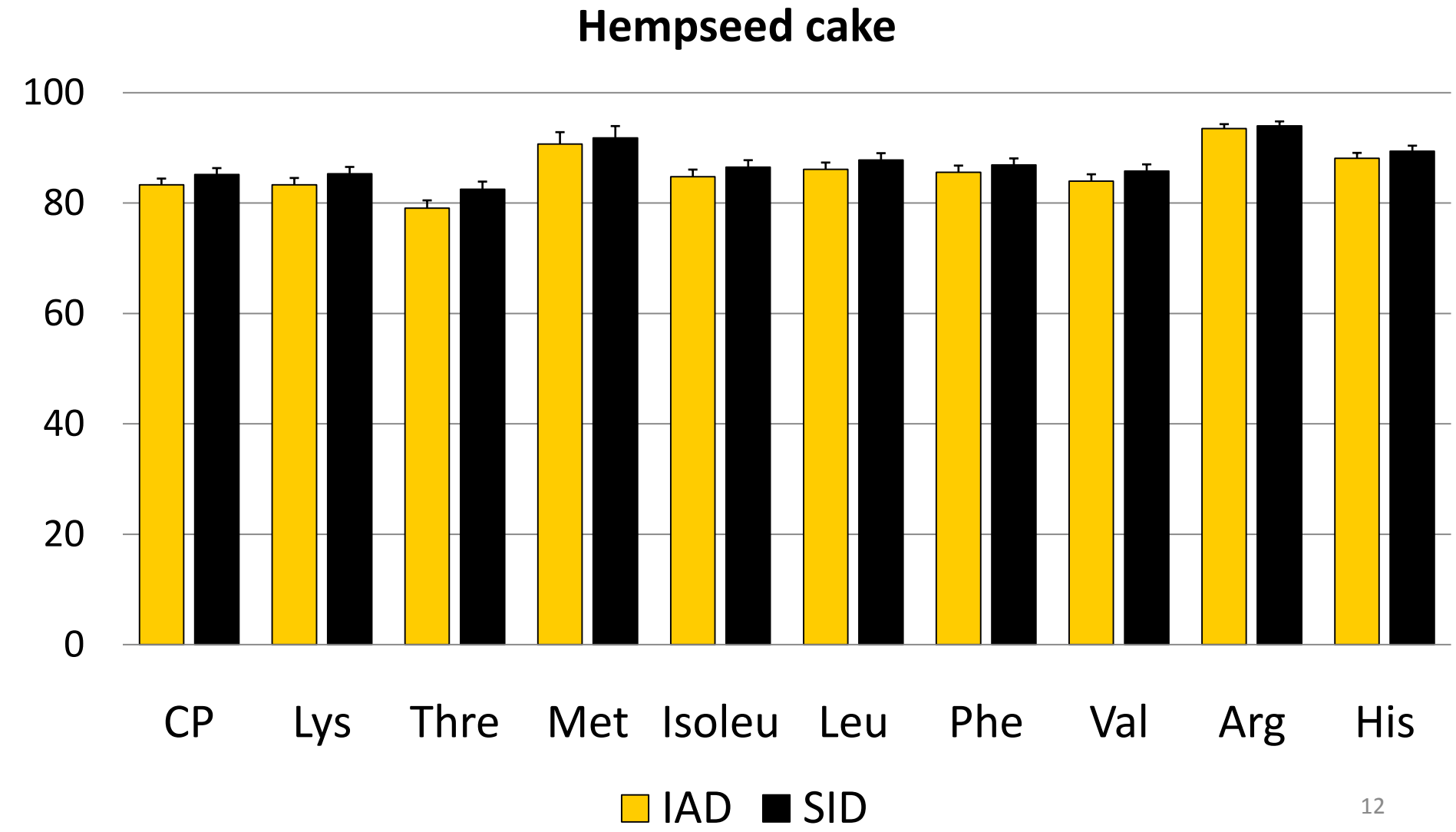
Feed ingredients:

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



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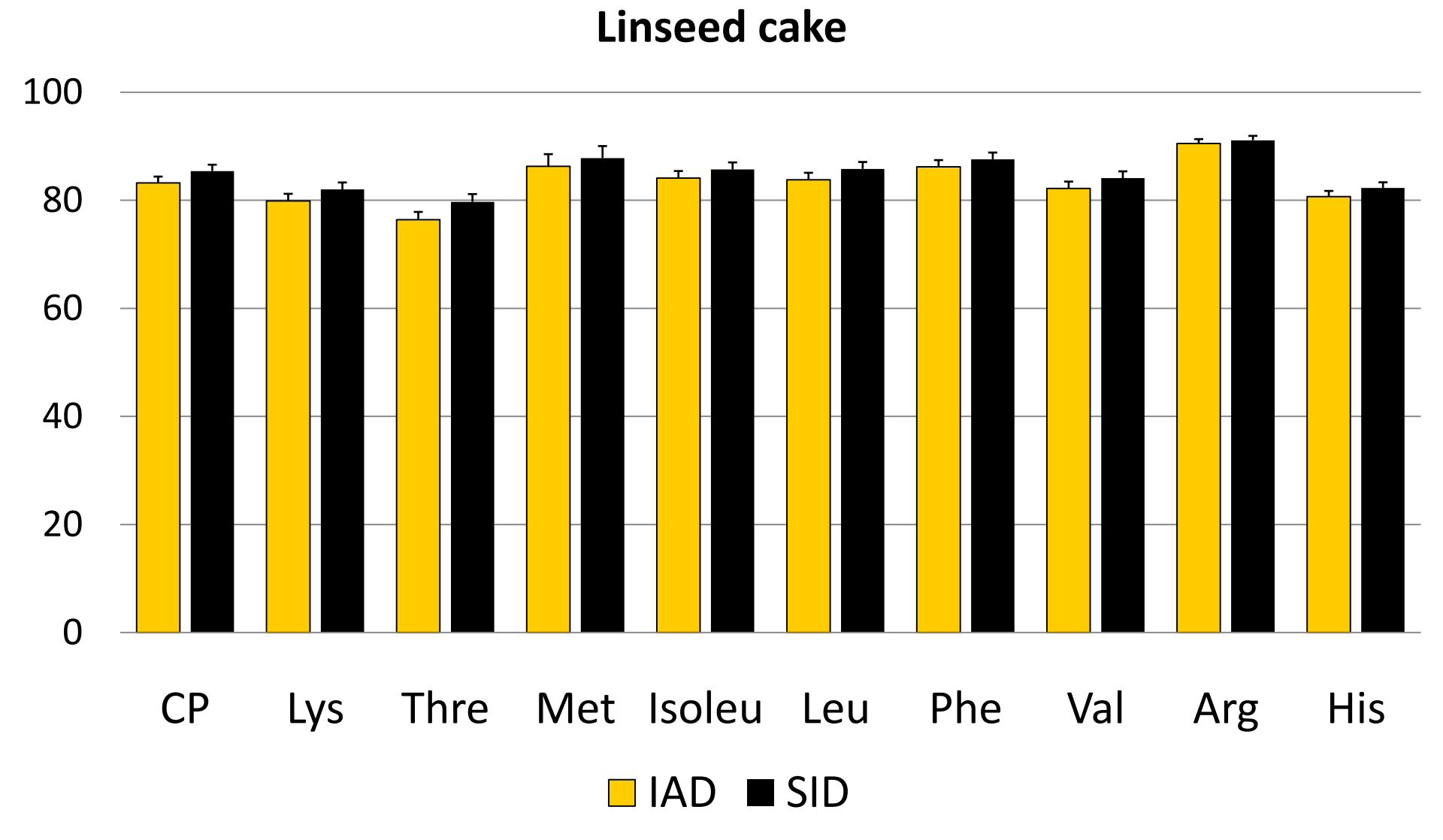

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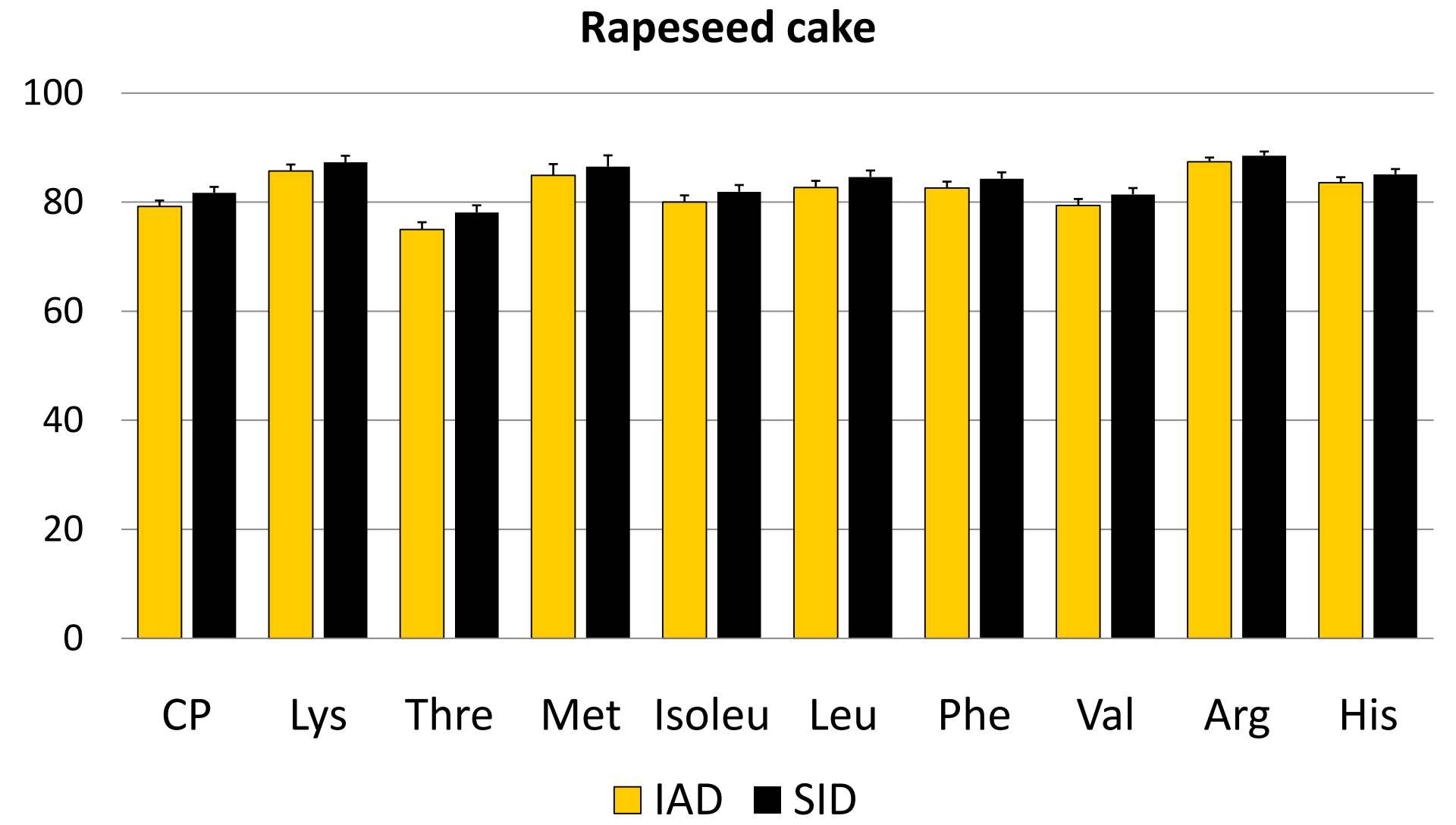

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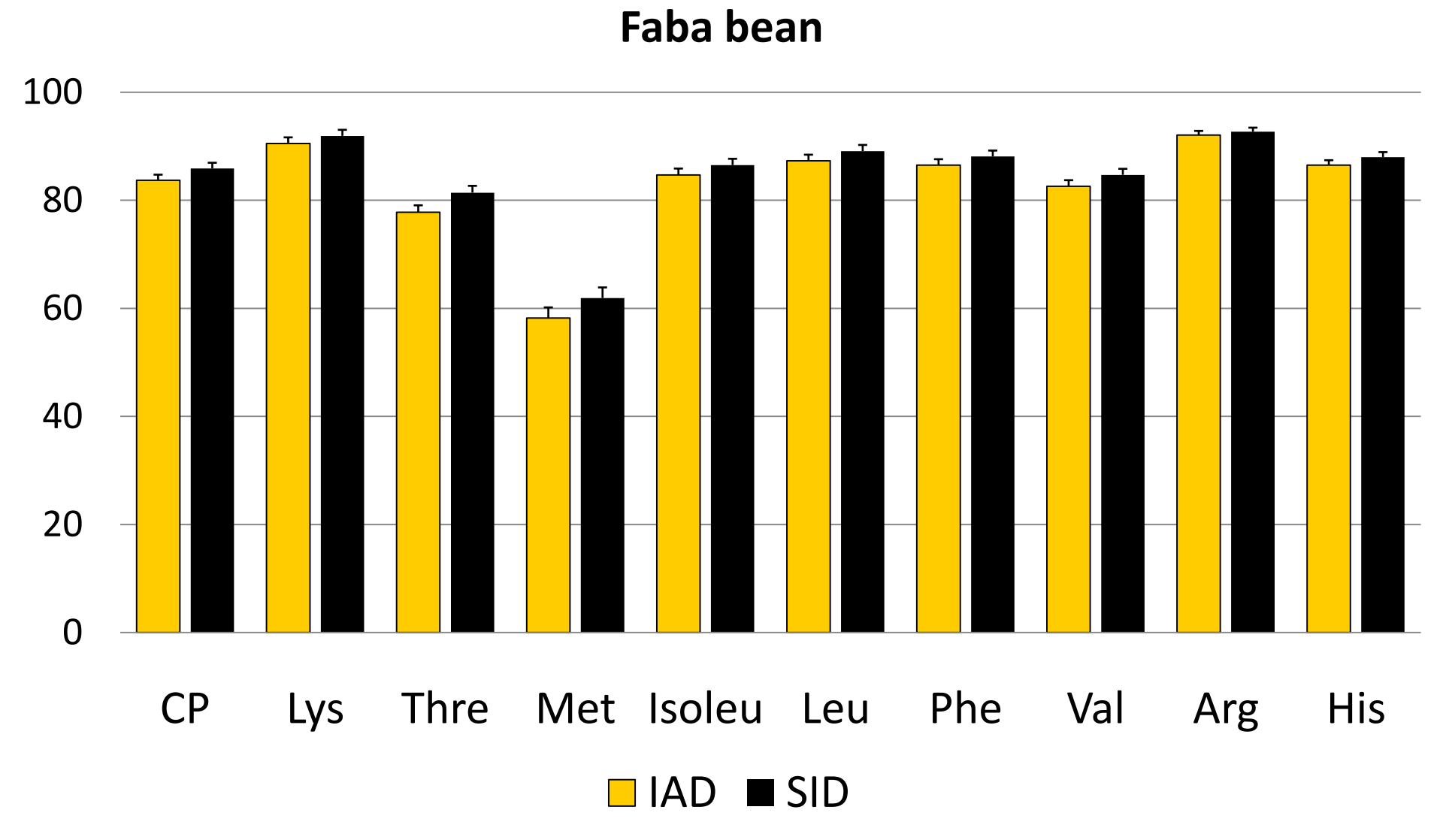

Conclusions

- 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!

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