Nutritional value of rapeseed meal

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Outline

Introduction & Objectives

Methods

Results

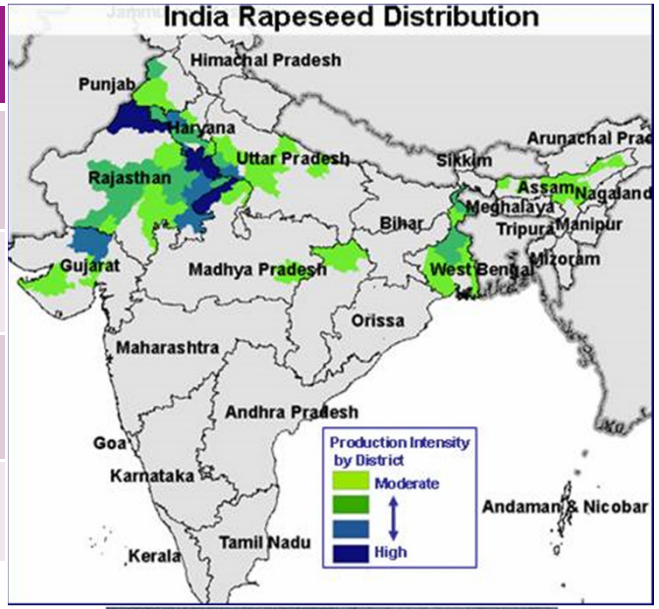
Nutrient content (Amino acid content / proximate / energy)

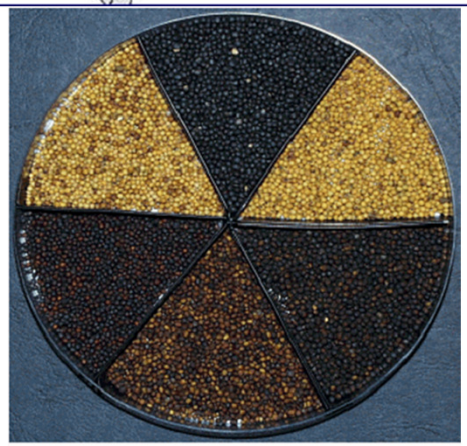
Glucosinolates – content & heat treatment

Conclusion

Introduction
Common species

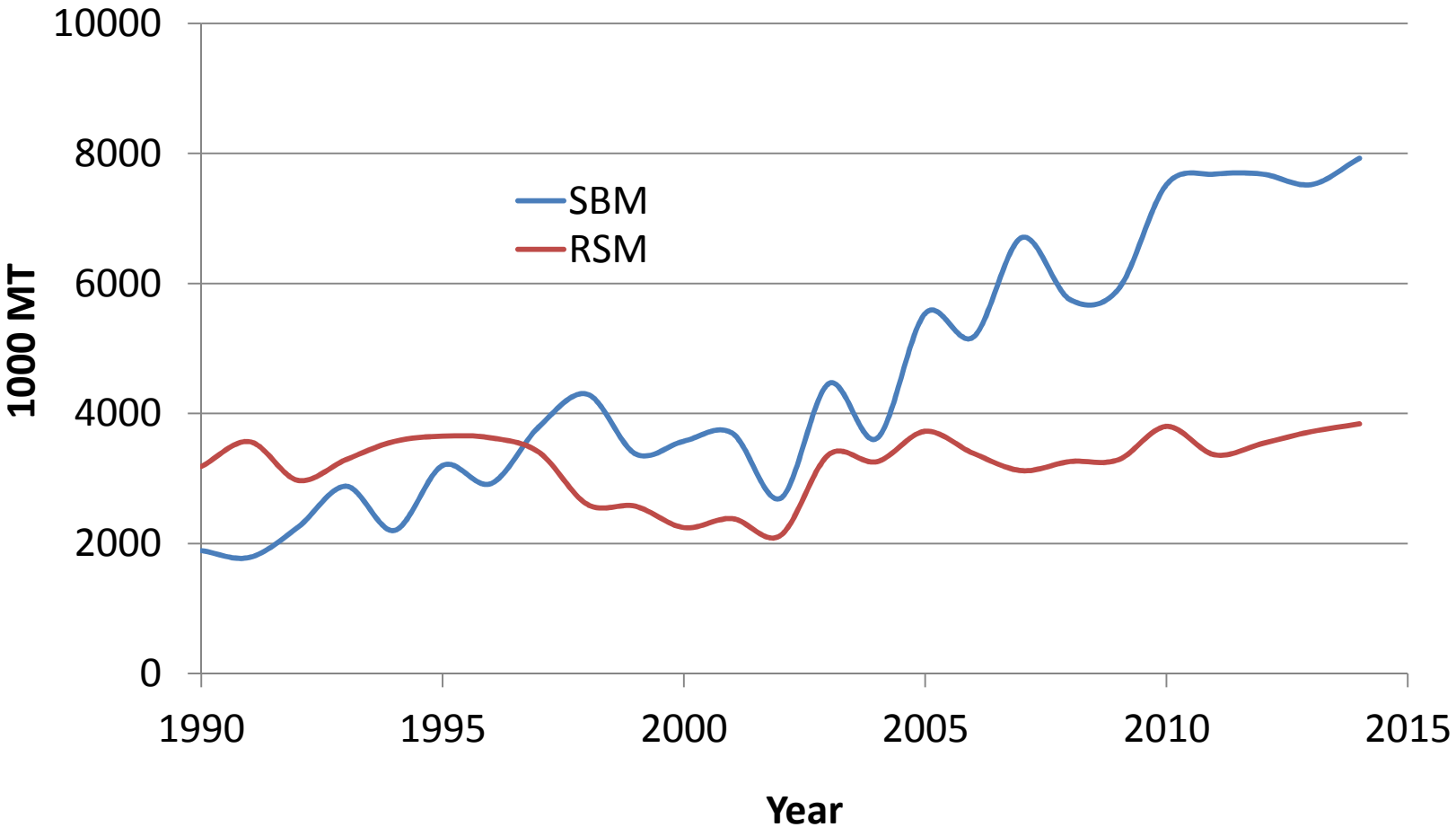
Species	Common name
Brassica juncea	Indian mustard
B. nigra	Black mustard
B. rapa / B. campestris	Indian rape / Polish rapeseed / Brown/Yellow sarson
B. napus	Rapeseed /canola





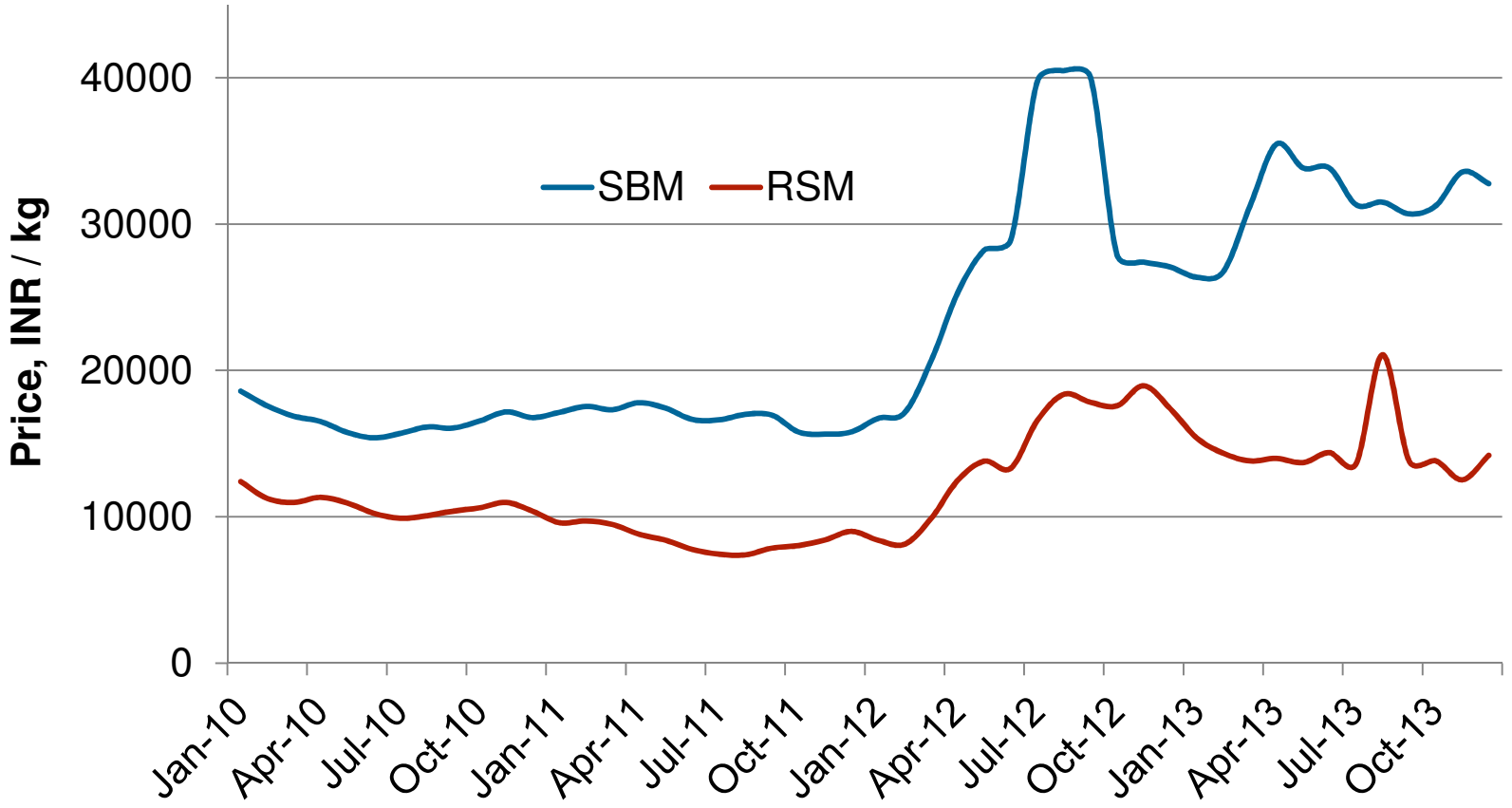
- Mustard is more heat and drought tolerant than canola
- Canola: **Can**ada + **ola** (Oil)
  - 00-rapeseed (<30 µmol/g glucosinolate in meal; <2% erucic acid in oil)

Introduction
Production of RSM vs. SBM, India



- India is the third largest producer of RSM globally, after China & Canada

Introduction
Price trend of RSM vs. SBM, India



Objectives

- Determine the content of essential amino acids (EAA) and proximate nutrients of Indian origin RSM samples collected during 2013.

- Estimate metabolisable energy (ME) content of RSM for poultry using prediction equation based on proximate nutrients

- Determine total glucosinolate contents of Indian RSM samples

Methods

Amino acids – NIR and wet chemistry (HPLC): n = 3073 samples

Proximate nutrients – NIR: n = 1743 samples

Metabolic energy – Rostagno equation; n = 1743 samples

Glucosinolates – wet chemistry (GC); n = 29 samples

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CP & Amino acid levels 2013 vs. Book value

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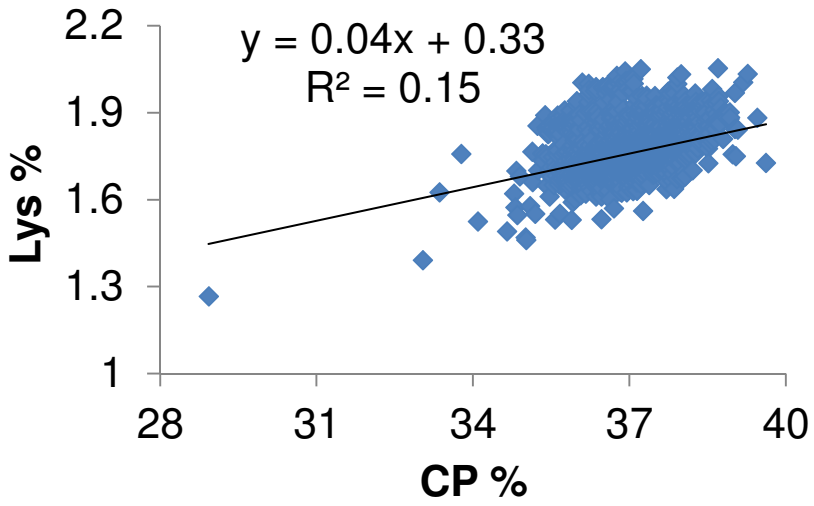
Mean value

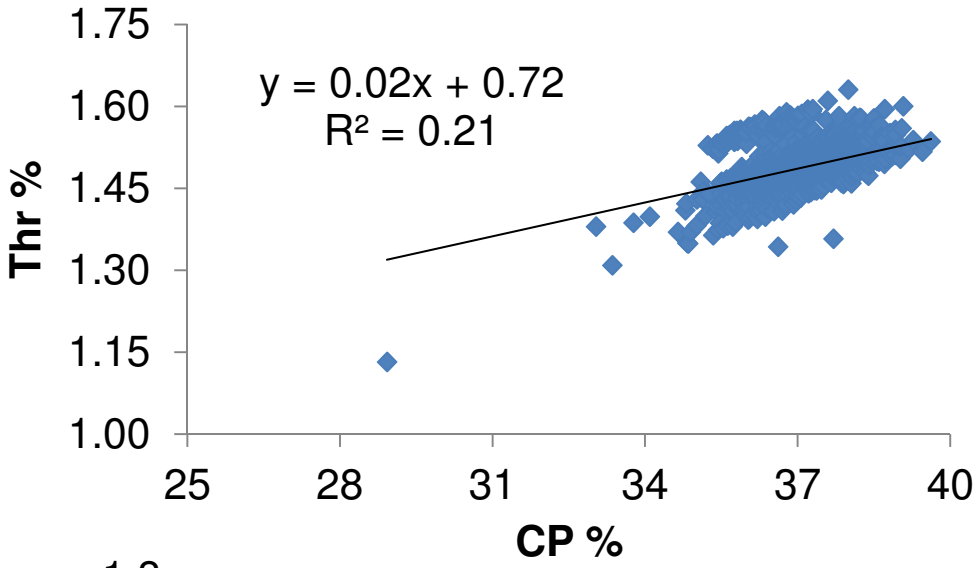
RSM 88% DM	2013 (n = 3073)	AMINODat 4.0 (n=28)
CP	37.09	37.20
LYS	1.76	**1.73**
MET	0.69	0.68
M+C	1.64	1.64
THR	1.49	**1.45**
TRP	0.50	0.53
ARG	2.32	2.42
ILE	1.43	**1.41**
LEU	2.48	2.48
VAL	1.81	**1.78**
HIS	1.01	1.00
PHE	1.46	1.46

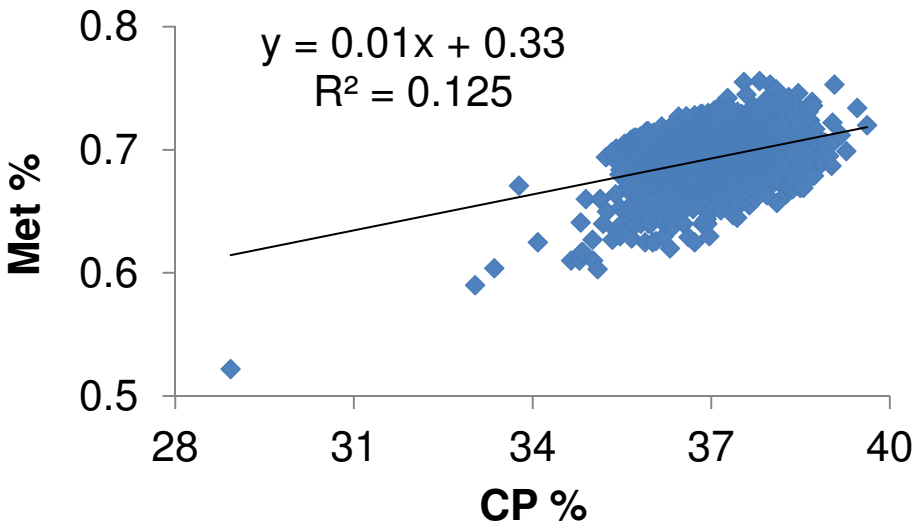
CP & Amino acid levels 2013 vs. Book value

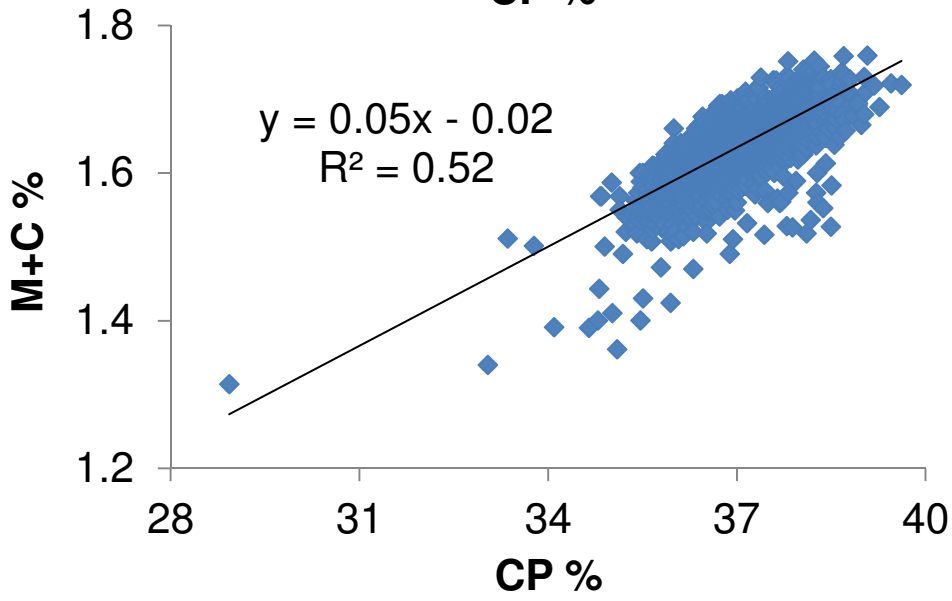
	Range			CV	
RSM, 88% DM	2013 (n = 3073)	AMINODat 4.0 (n=28)		2013 (n = 3073)	AMINODat 4.0 (n=28)
CP	28.93 - 39.62	34.30 - 39.10		1.90	3.50
LYS	1.27 - 2.05	1.51 - 1.97		3.99	6.60
MET	0.52 - 0.76	0.62 - 0.73		3.78	4.30
M+C	1.31 - 1.76	1.45 - 1.75		2.66	4.50
THR	1.13 - 1.63	1.32 - 1.53		2.12	3.20
TRP	0.41 - 0.56	0.51 - 0.55		2.93	3.10
ARG	1.79 - 2.62	2.10 - 2.63		3.90	4.80
ILE	1.12 - 1.53	1.29 - 1.51		2.19	3.90
LEU	1.92 - 2.68	2.25 - 2.63		1.97	3.60
VAL	1.39 - 1.95	1.64 - 1.88		2.25	3.50
HIS	0.77 - 1.14	0.91 - 1.08		3.58	4.30
PHE	1.14 - 1.57	1.30 - 1.56		2.23	4.10

CP-AA relationship
Poor fit

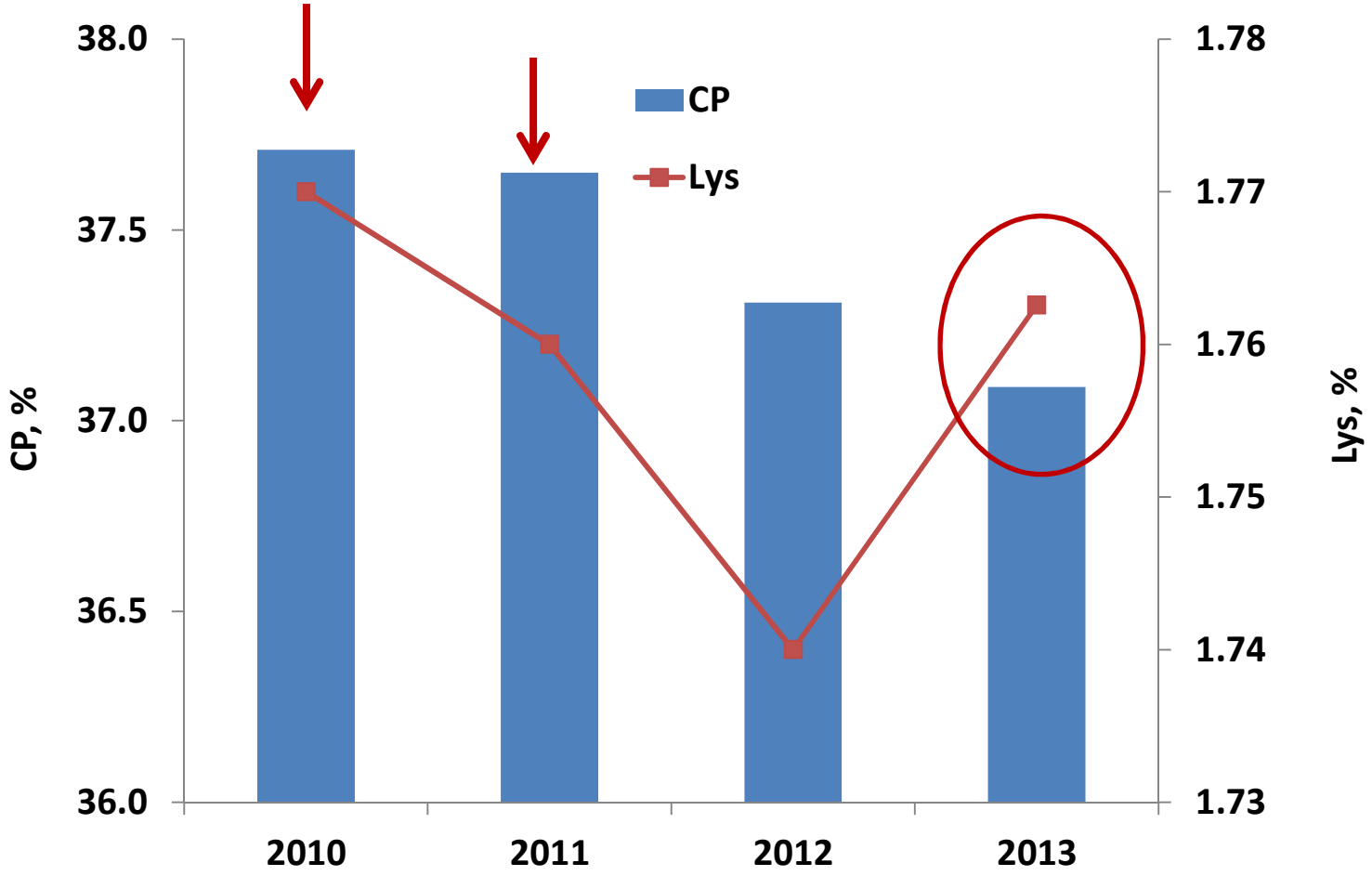








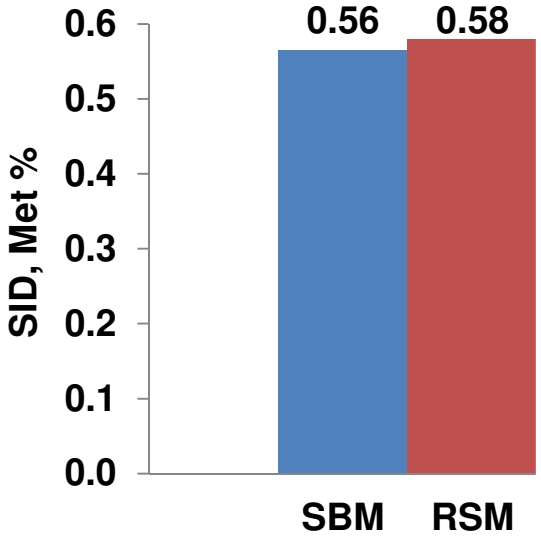
AA is not always related to CP

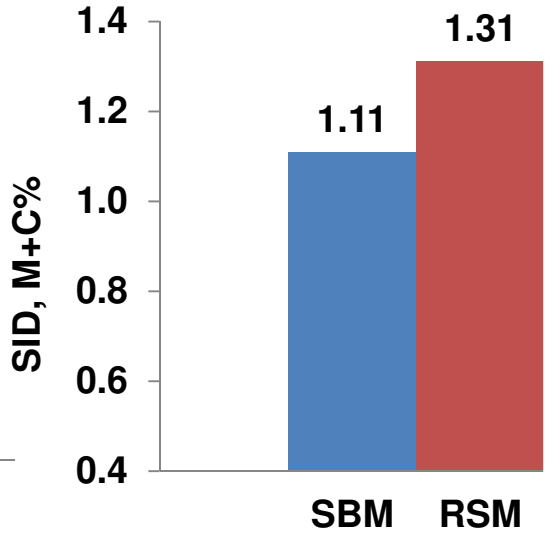


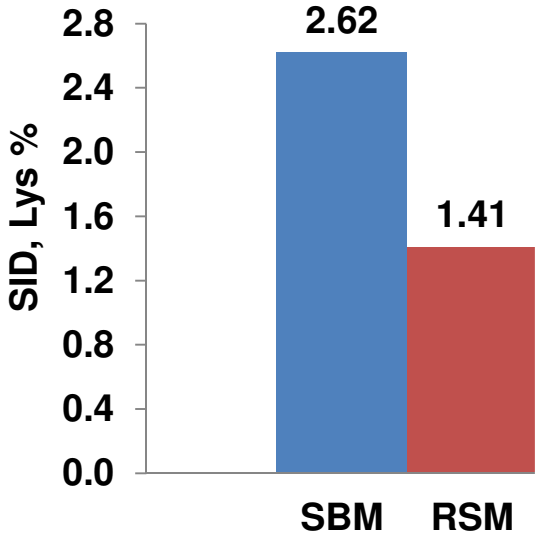
CP & Amino acid levels
RSM vs. SBM

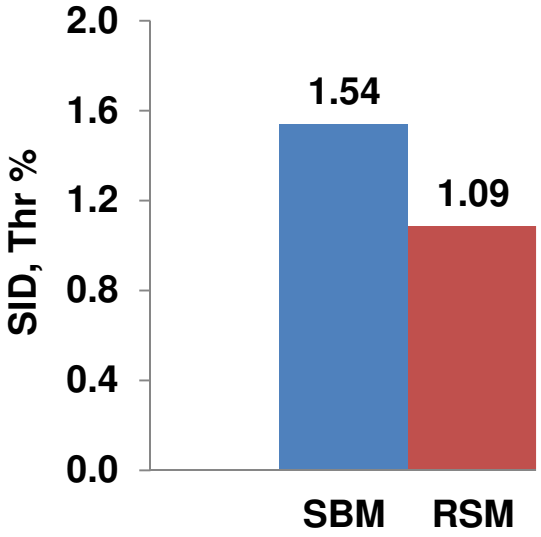
88% DM	RSM (n= 3073)	SBM (n=5660)
CP	37.09	47.33
LYS	1.76	2.91
MET	**0.69**	0.62
M+C	**1.64**	1.29
THR	1.49	1.81
TRP	0.50	0.62
ARG	2.32	3.53
ILE	1.43	2.11
LEU	2.48	3.57
VAL	1.81	2.2
HIS	1.01	1.26
PHE	1.46	2.40

Amino acid content, SID basis
Comparisons with other raw material







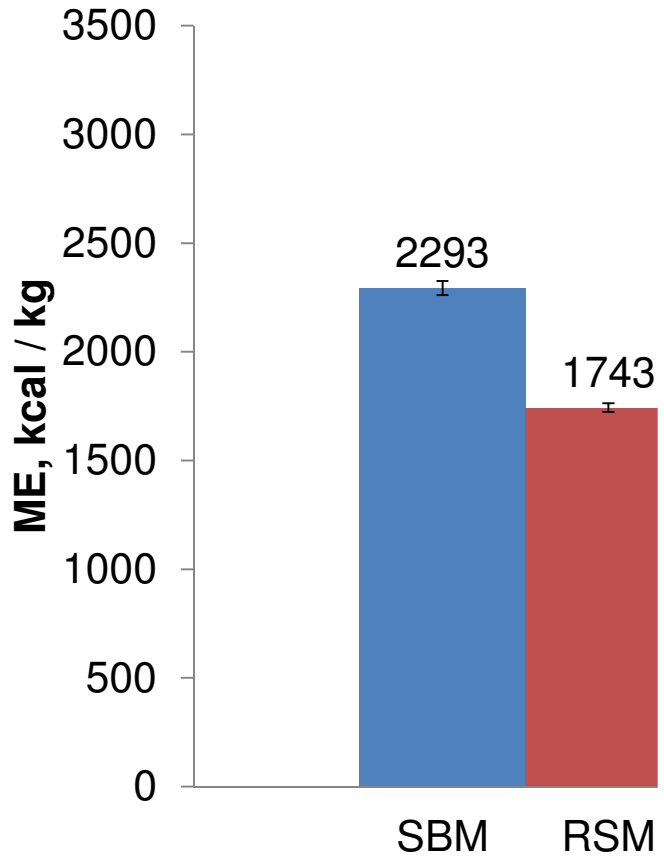


SBM, n = 5660
RSM, n = 3073
CSM, n = 462
MBM, n = 626

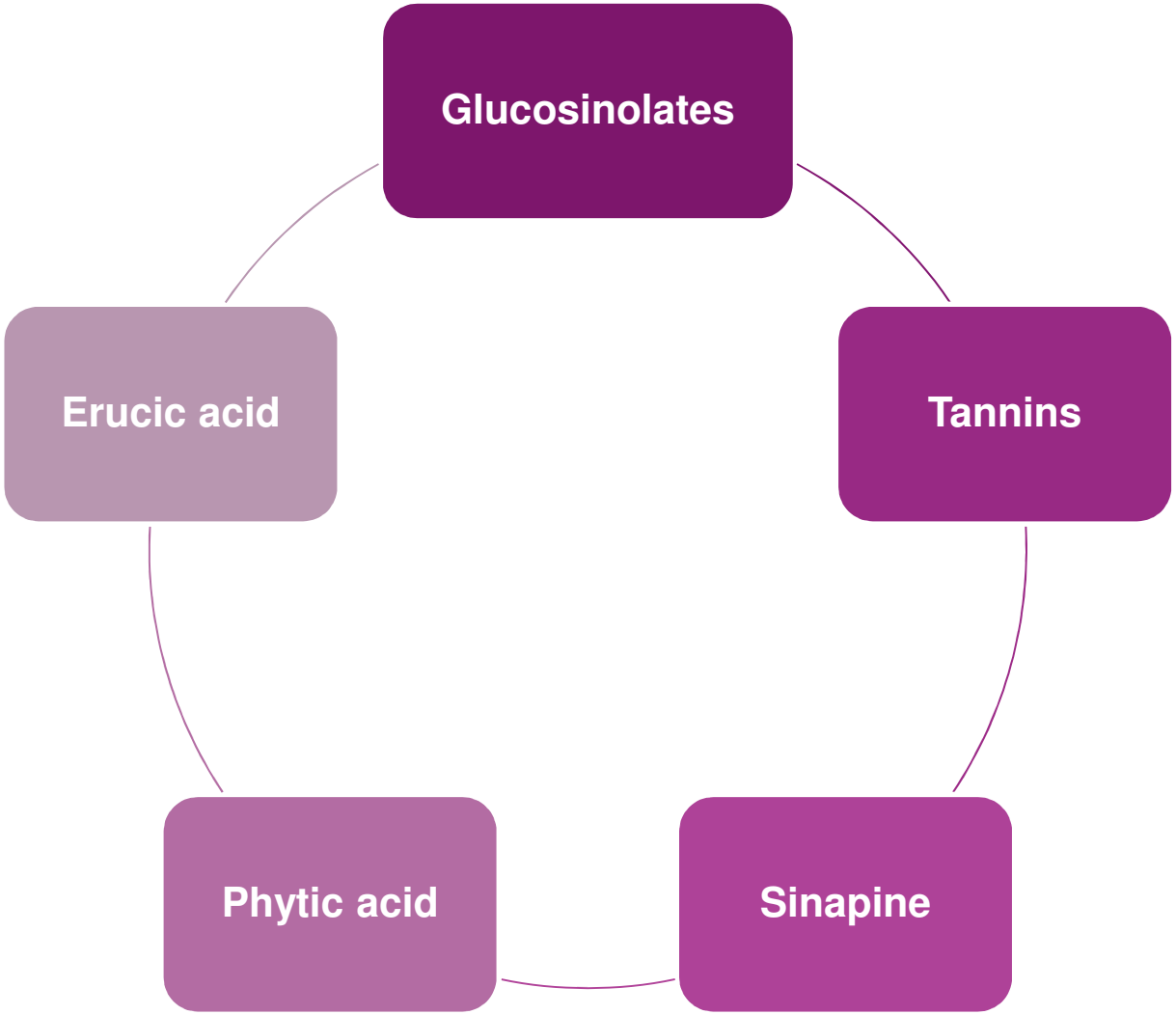
Proximate nutrients
RSM vs. SBM

	SBM (n = 5617)	RSM (n = 1743)
Moisture %	12	12
CP %	47.30 ± 0.72	**37.01** ± 0.71
Crude Fat %	1.92 ± 0.54	2.76 ± 0.34
Ash %	7.19 ± 0.50	**6.98** ± 0.32
Crude Fiber %	5.25 ± 1.16	**10.45** ± 0.43
NFE %	26.34 ± 1.28	30.77 ± 0.86

Metabolizable Energy, poultry
RSM vs. others



Antinutritional factors



Glucosinolates

- 140 different Glucosinolates
- 27 are known in rapeseed

Plant: Part of the defence system

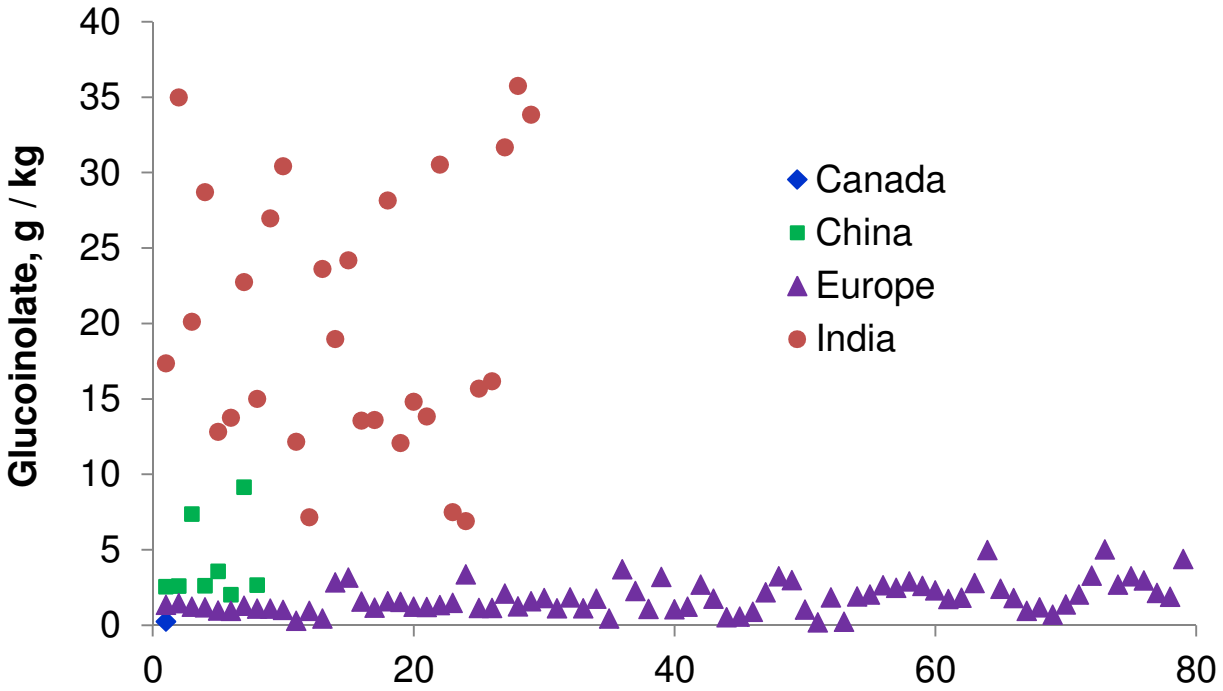
Animals: Interfere with **iodine uptake** and the sythesis of Thyroid hormones T3 and T4, leading to hypothyroidism and enlargement of the thyroid gland (**goitre)**.

- growth retardation
- impaired liver and kidney functions
- impaired reproductive activity

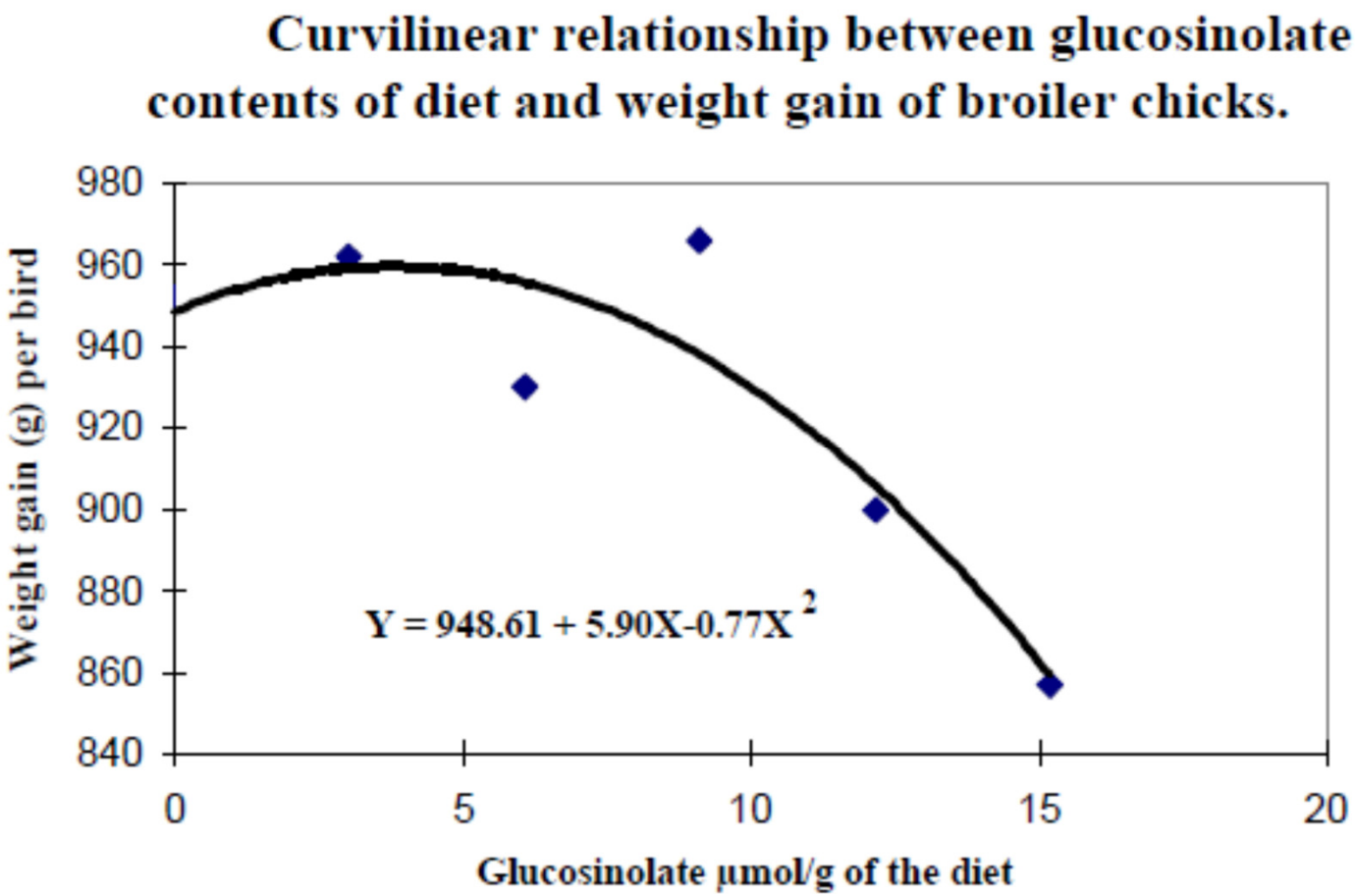
RSM vs. Mustard meal
Glucosinolate content

Glucosinolates (g/kg)	RSM (n = 29)
Gluconasturtiin	0.146
Glucoraphanin	0.055
Progoitrin	0.093
Glucotropaeolin	0.003
Glucobrassicin	0.003
Sinigrin	**3.618**
Epiprogoitrin	0.012
Glucoiberin	0.170
Glucoerucin	0.012
Gluconapin	**15.995**
Sum of glucosinolates,	**20.10**
mmol/kg	**43.32**

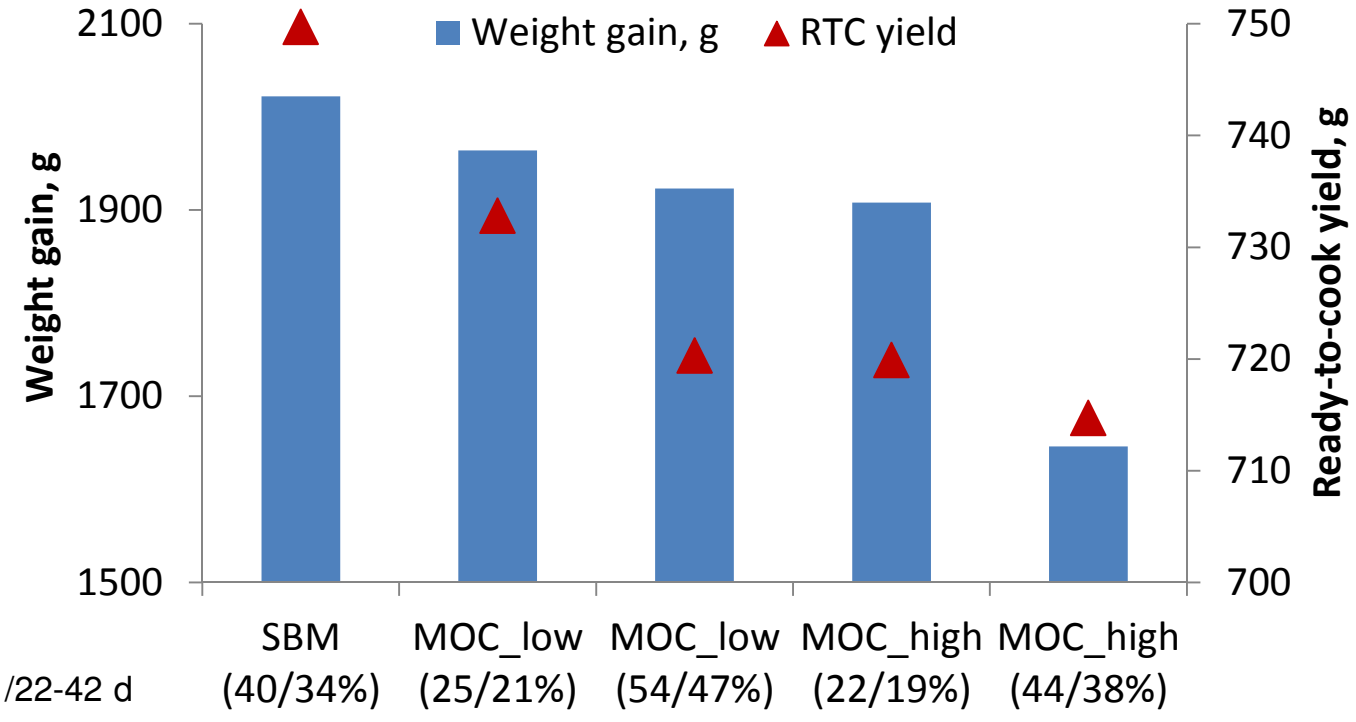
RSM: Glucosinolate content



RSM in broiler diets



RSM in broiler diets

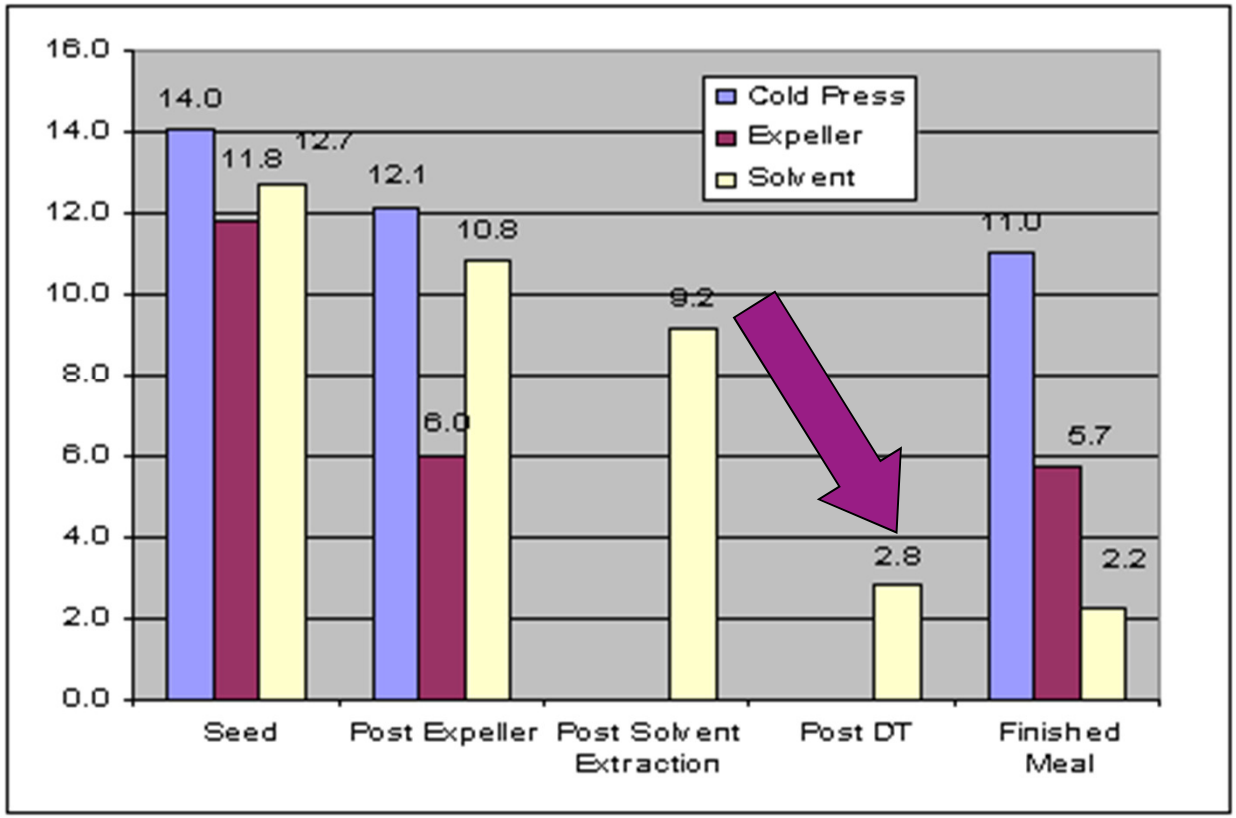


FCR	1.76	1.73	1.71	1.8	1.91

Rama Rao et al. 2004

Glucosinolates can be destroyed via heating

Figure 4 Glucosinolate content of seed, in-process and finished meal canola samples (µmoles/g, oil free 10% moisture basis)



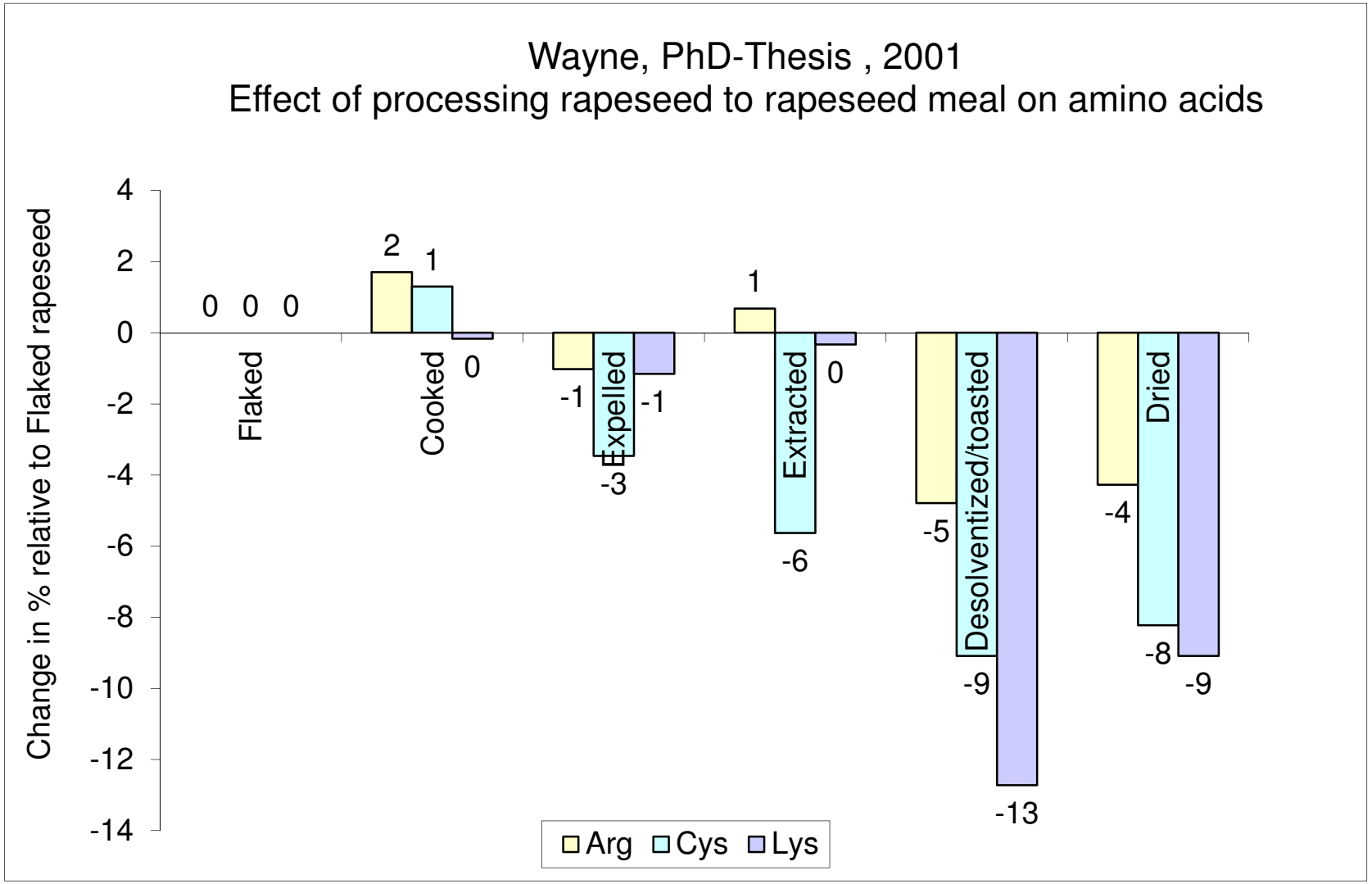
Toasting has the biggest impact on Glucosinolate levels
In this example desolventization/toasting causes about 2/3 of the total reduction!

Spragg and Mailer, 2007; AOF/Pork CRC report

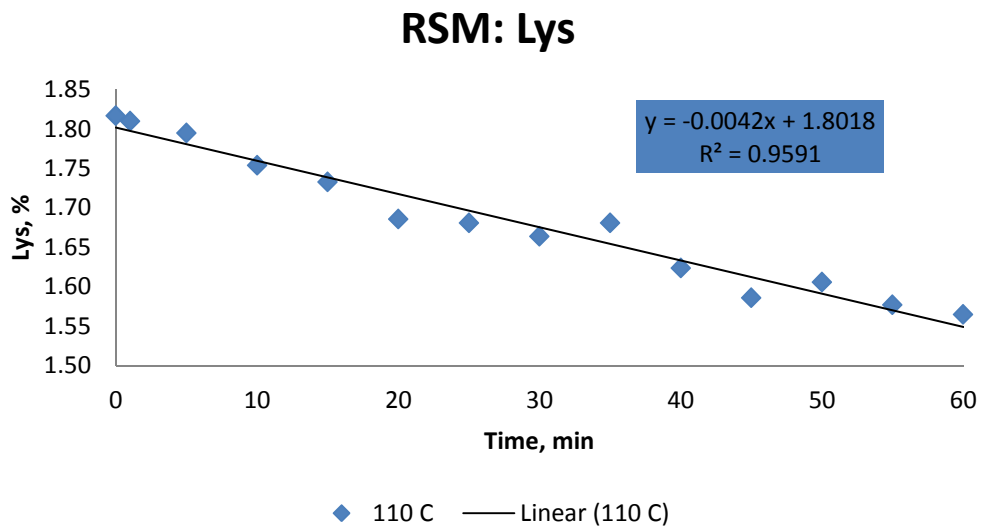
Porcessing is needed to reduce the Glucosinolates.

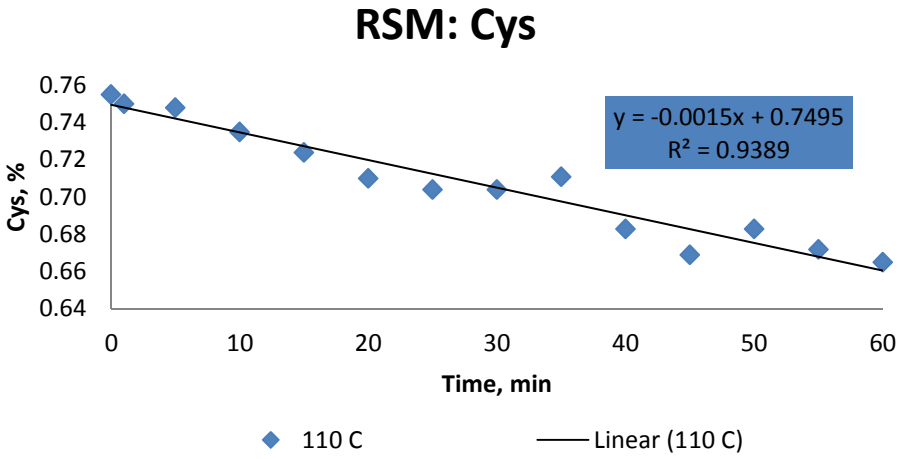
Can we overdo it?

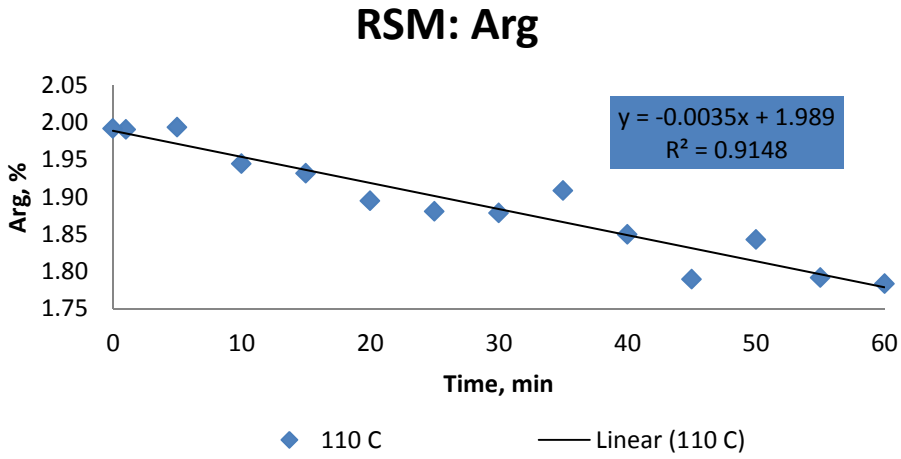
Toasting is the most harmfull process step



Linear loss of total Lys, Cys and Arg in RSM due to heating at 110 C







Legal constraints for glucosinolates in Europe

Rapeseed meal (88% DM): max 4.00 g/kg = 8.6 mmol/kg

Finished Feed (88% DM):

Piglets: max 0.15 g/kg = 0.32 mmol/kg

Pig + Poultry: max 0.50 g/kg = 1.07 mmol/kg

Max dietary inclusion rate of 00-RSM

Piglets	Pig+Poultry
3.75 %	12.50 %

Max dietary inclusion rate of Indian-RSM (20 g/kg)

Piglets	Pig+Poultry
0.75 %	2.50 %

Summary

- RSM vs. SBM:

  Cheaper and higher Met (0.07%) & M+C (0.35%) levels

  Higher crude fiber (5%) and Lower CP (10%) & ME (550 kcal/kg: 2300 v 1750)

- Poor relationship between CP and EAA – regression equation not possible

- High glucosinoate contents

  RSM: 20 g/kg Mustard meal: 23.78 g/kg

- Heat processing helps reduce glucosinolate content, but overprocessing reduces Lys, Arg and Cys

  - A balance between Glucosinolates and heat-damage needs to be found

- Inclusion rate of RSM as per European regulation, 2.5%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