FEEDING OF EXTRUDED RAPE CAKES AND OF EXTRUDED FULL FAT SOYA AT DAIRY COWS

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The aim of the trial

to evaluate the influence of

- extruded rape cakes and
- extruded full fat soya

as protein sources on

- milk performance
- nutrient consumption

Experimental design

- four lactating dairy cows (mean milk yield 22.8 kg and BW 628 kg)
- two groups (each 2 cows) - Latin square (2 x 2)
- two periods (each 42 days – two estrous cycles)
- each period included: preliminary period (21 days) and trial period (21 days)
- diets: isonitrogenous and isoenergetic
- collected samples: feeds, orts, milk and jugular blood

  three times weekly in trial period

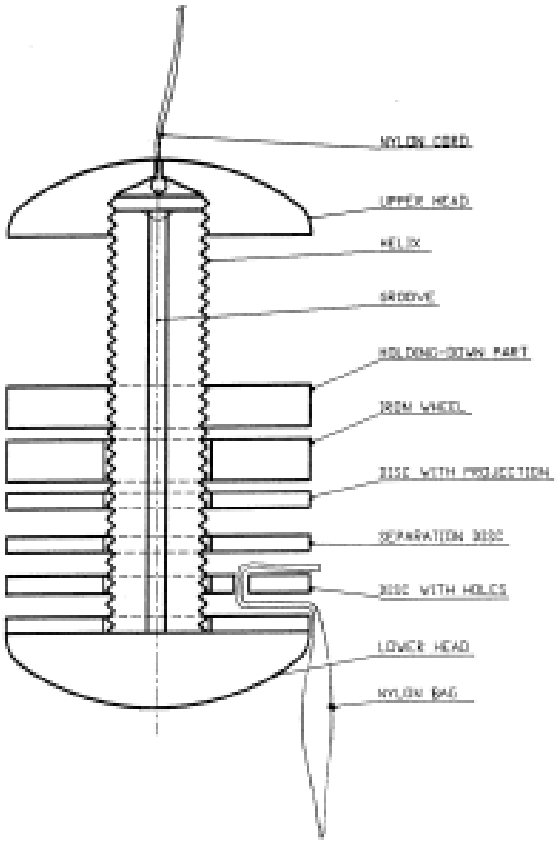
Chemical analysis:

Feeds - DM, ash, fat, CP, CF, NDF, ADF - amino acids

Milk - fat and protein

Blood plasma - amino acids

Carrier for nylon bag method



Calculations

Calculation of NEL and PDI and diet balancing:

Sommer A. et al.1994. Nutrient requirement and tables of nutritional value of feeds for ruminants. Pohořelice 1994, 198 p.

Calculation of AADI values of feeds:

Rulquin H., Vérité R., Guinard-Flament J. 2001. Amino acids digestible in the small intestine : the AADI system for the dairy cow. INRA Production Animales 14: 265–274.

Rulquin H., Vérité R., Guinard-Flament J. 2001. Table of AADI value of feedstuffs for ruminants. INRA Production Animales 14: 1–16.

Results

Table 1. Comparison of nutrients contents of protein sources.
extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean).

Item	Unit	Rapeseed	Soybean	Differ. (%)
Organic matter	$g.kg^{-1}$	935	942	-0.8
CP	$g.kg^{-1}$	371	433	-16.7
Fat	$g.kg^{-1}$	101	195	-93.5
CF	$g.kg^{-1}$	172	60	65.1
NDF	$g.kg^{-1}$	299	122	59.4
ADF	$g.kg^{-1}$	259	97	62.8
deg[1]	%	73	47	35.6
PDIA	$g.kg^{-1}$	83	224	-168.7
PDIN	$g.kg^{-1}$	233	327	-40.2
PDIE	$g.kg^{-1}$	126	259	-105.8
NEL	$MJ.kg^{-1}$	7.73	9.32	-20.5

[1] nitrogen effective degradability

Table 2. Content of amino acids in protein sources.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Amino Acid	Unit	Rapeseed	Soybean	Differ. (%)
Essential				
Arg	g.kg DM $^{-1}$	25.1	40.6	-62.2
His	g.kg DM $^{-1}$	9.5	12.1	-27.7
Ile	g.kg DM $^{-1}$	14.7	19.2	-31.0
Leu	g.kg DM $^{-1}$	25.3	33.2	-31.5
Lys	g.kg DM $^{-1}$	21.4	29.3	-37.1
Met	g.kg DM $^{-1}$	5.4	6.0	-11.0
Phe	g.kg DM $^{-1}$	14.4	23.9	-65.9
Thr	g.kg DM $^{-1}$	15.3	15.5	-1.7
Val	g.kg DM $^{-1}$	19.0	21.2	-12.1
Nonessential				
Ala	g.kg DM $^{-1}$	9.1	14.2	-55.9
Asp	g.kg DM $^{-1}$	23.7	44.1	-86.0
Glu	g.kg DM $^{-1}$	58.3	75.8	-30.0
Gly	g.kg DM $^{-1}$	18.7	17.2	8.0
Pro	g.kg DM $^{-1}$	28.0	27.9	0.2
Ser	g.kg DM $^{-1}$	15.3	20.2	-31.9
Tyr	g.kg DM $^{-1}$	9.9	14.8	-49.1

Table 3. Amino acid profile of protein sources.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Amino acid	Unit[1]	Rapeseed	Soybean	Differ. (%)
Essential				
Arg	%TAA	8.01	9.78	-22.1
His	%TAA	3.04	2.93	3.8
Ile	%TAA	4.68	4.62	1.3
Leu	%TAA	8.08	8.00	0.9
Lys	%TAA	6.84	7.06	-3.3
Met	%TAA	1.73	1.45	16.4
Phe	%TAA	4.60	5.75	-25.0
Thr	%TAA	4.89	3.74	23.4
Val	%TAA	6.06	5.11	15.6
Nonessential				
Ala	%TAA	2.92	4.54	-55.9
Asp	%TAA	7.57	14.09	-86.0
Glu	%TAA	18.63	24.22	-30.0
Gly	%TAA	5.97	5.49	8.0
Pro	%TAA	8.94	8.92	0.2
Ser	%TAA	4.88	6.45	-31.9
Tyr	%TAA	3.16	4.72	-49.1

[1] TAA - total amino acids

Table 4. AADI values (digestible amino acids in the intestine) of protein sources.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)
calculated according to Rulquin (2001, INRA Prod. Anim., 14: 265-274).

AADI	Unit	Rapeseed	Soybean	Differ. (%)
ArgDI	%PDIE	5.50	6.41	-16.6
HisDI	%PDIE	2.38	2.47	-3.8
IleDI	%PDIE	5.14	4.97	3.3
LeuDI	%PDIE	8.35	8.37	-0.3
LysDI	%PDIE	7.19	7.17	0.2
MetDI	%PDIE	1.72	1.44	16.4
PheDI	%PDIE	4.71	5.51	-17.1
ThrDI	%PDIE	5.10	4.48	12.1
ValDI	%PDIE	5.86	5.30	9.5

Table 5. Composition of mixture.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean).

Component	Unit	Rapeseed	Soybean
Beet pulp (dried)	%	14.2	15.0
Barley	%	26.7	29.6
Oats	%	26.7	29.6
Rapeseed oil	%	1.2	
Rapeseed cake (extruded)	%	26.2	
Soybean (full fat, extruded)	%		20.7
NaCl	%	0.6	0.6
DCP	%	1.7	1.7
CaCO3	%	1.7	1.7
NaHCO3	%	0.1	0.1
MSP	%	0.2	0.2
MgP	%	0.2	0.2
Premix (trace metals, vitamins)	%	0.6	0.6

Table 6. Nutrients content in mixture.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed	Soybean	Differ. (%)
Organic matter	$g.kg^{-1}$	919.6	898.8	2.3
CP	$g.kg^{-1}$	171.3	173.0	-1.0
Fat	$g.kg^{-1}$	61.0	58.1	4.8
CF	$g.kg^{-1}$	99.9	82.7	17.2
NDF	$g.kg^{-1}$	261.7	229.5	12.3
ADF	$g.kg^{-1}$	132.1	101.9	22.8
PDIA	$g.kg^{-1}$	41.0	56.1	-37.0
PDIN	$g.kg^{-1}$	109.0	118.2	-8.4
PDIE	$g.kg^{-1}$	97.0	110.6	-14.1
NEL	$MJ.kg^{-1}$	6.45	6.44	0.3

Table 7. AADI values (digestible amino acids in the intestine) of diets.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

AADI	Unit	Rapeseed		Soybean		Differ. (%)	P[1] (n = 12)	Requir.[2]
		Mean	SEM	Mean	SEM			
ArgDI	% PDIE	4.86	0.00	5.07	0.00	-4.3	***	4.3
HisDI	% PDIE	2.07	0.00	2.07	0.00	-0.1	**	2.5-3.2
IleDI	% PDIE	5.38	0.00	5.36	0.00	0.5	***	5.0
LeuDI	% PDIE	8.77	0.01	8.63	0.01	1.6	***	8.8
LysDI	% PDIE	6.94	0.01	6.81	0.00	1.8	***	7.3
MetDI	% PDIE	1.89	0.00	1.78	0.00	5.8	***	2.5
PheDI	% PDIE	4.98	0.00	5.12	0.00	-2.9	***	4.0-5.0
ThrDI	% PDIE	5.21	0.00	5.12	0.00	1.7	***	4.0
ValDI	% PDIE	6.03	0.00	5.91	0.00	1.9	***	5.3

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

[2] requirement of amino acids according to Rulquin (2001. INRA Prod. Anim.14: 265-274)

Table 8. Intake of nutrients of diets.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed		Soybean		Difference (%)	P[1] (n = 36)
		Mean	SEM	Mean	SEM		
DMI	kg.day^{-1}	18.58	0.14	18.77	0.13	-1.0	NS
Organic matter	kg.day^{-1}	17.34	0.14	17.33	0.12	0.1	NS
CP	kg.day^{-1}	2.36	0.03	2.39	0.02	-1.3	NS
Fat	kg.day^{-1}	0.83	0.01	0.81	0.01	2.6	***
CF	kg.day^{-1}	3.22	0.02	3.12	0.02	3.1	***
NDF	kg.day^{-1}	7.02	0.07	6.83	0.05	2.8	**
ADF	kg.day^{-1}	3.89	0.05	3.68	0.04	5.3	***
PDIA	kg.day^{-1}	0.55	0.01	0.69	0.01	-24.9	***
PDIN	kg.day^{-1}	1.48	0.02	1.57	0.02	-6.1	***
PDIE	kg.day^{-1}	1.53	0.02	1.66	0.01	-8.7	***
NEL	MJ.day^{-1}	115.2	0.9	116.0	0.8	-0.7	NS

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

Table 9. Intake of AADI (digestible amino acids in the intestine) (AADI) of diets.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

AADI	Unit	Rapeseed		Soybean		Difference	P[1]
		Mean	SEM	Mean	SEM	(%)	(n = 36)
ArgDI	$g.day^{-1}$	74.5	0.8	84.4	0.7	-13.3	***
HisDI	$g.day^{-1}$	31.7	0.3	34.5	0.3	-8.7	***
IleDI	$g.day^{-1}$	82.4	0.8	89.1	0.7	-8.2	***
LeuDI	$g.day^{-1}$	134.4	1.4	143.7	1.2	-6.9	***
LysDI	$g.day^{-1}$	106.2	1.0	113.3	0.9	-6.7	***
MetDI	$g.day^{-1}$	29.0	0.3	29.7	0.2	-2.3	**
PheDI	$g.day^{-1}$	76.2	0.7	85.2	0.7	-11.8	***
ThrDI	$g.day^{-1}$	79.8	0.8	85.2	0.7	-6.8	***
ValDI	$g.day^{-1}$	92.3	0.9	98.4	0.8	-6.6	***

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

Table 10. Effect of diets on concentration of essential amino acids in jugular plasma.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed		Soybean		Difference	P[1]
		Mean	SEM	Mean	SEM	(%)	(n=36)
Thr	$mg.L^{-1}$	7.47	0.42	7.88	0.37	-5.5	NS
Val	$mg.L^{-1}$	22.04	0.96	23.61	0.84	-7.1	NS
Cys[2]	$mg.L^{-1}$	7.89	0.33	7.60	0.32	3.7	NS
Met	$mg.L^{-1}$	2.79	0.15	2.85	0.12	-2.3	NS
Ile	$mg.L^{-1}$	12.37	0.55	13.96	0.51	-12.8	*
Leu	$mg.L^{-1}$	11.60	0.50	11.54	0.45	0.5	NS
Tyr[2]	$mg.L^{-1}$	7.69	0.36	8.84	0.34	-14.9	*
Phe	$mg.L^{-1}$	6.62	0.29	6.29	0.21	4.9	NS
Lys	$mg.L^{-1}$	10.71	0.49	11.55	0.46	-7.8	NS
His	$mg.L^{-1}$	7.43	0.31	7.23	0.34	2.7	NS
Arg	$mg.L^{-1}$	12.20	0.57	13.94	0.65	-14.3	*

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

[2] semi-essential amino acids

Table 11. Effect of diets on concentration of nonessential amino acids in jugular plasma.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed		Soybean		Difference	P[1]
		Mean	SEM	Mean	SEM	(%)	(n = 36)
Taur	$mg.L^{-1}$	5.05	0.30	4.29	0.30	15.1	*
Asp	$mg.L^{-1}$	1.40	0.08	1.42	0.06	-1.1	NS
Ser	$mg.L^{-1}$	7.66	0.42	8.36	0.38	-9.2	NS
Asn	$mg.L^{-1}$	5.94	0.36	7.45	0.33	-25.5	**
Glu	$mg.L^{-1}$	9.28	0.55	7.98	0.41	14.0	*
Gln	$mg.L^{-1}$	45.81	3.63	57.33	3.47	-25.1	*
Pro	$mg.L^{-1}$	6.72	0.30	7.86	0.44	-16.9	*
Gly	$mg.L^{-1}$	26.29	1.92	27.81	1.22	-5.8	NS
Ala	$mg.L^{-1}$	18.85	0.93	22.85	0.89	-21.3	**
Cit	$mg.L^{-1}$	11.02	0.67	14.51	0.68	-31.6	***
Orn	$mg.L^{-1}$	6.80	0.28	7.76	0.32	-14.1	*

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

Table 12. Effect of diets on concentration of total (TAA), essential (EAA), nonessential (NAA) and branched-chain (BCAA) amino acids in jugular plasma.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed		Soybean		Difference	P[1]
		Mean	SEM	Mean	SEM	(%)	(n = 36)
TAA	$mg.L^{-1}$	253.3	9.8	281.8	8.6	-11.2	*
EAA	$mg.L^{-1}$	108.8	4.2	115.3	3.8	-6.0	NS
BCAA	$mg.L^{-1}$	154.8	6.1	164.4	5.4	-6.2	NS
NAA	$mg.L^{-1}$	144.5	6.8	166.5	5.5	-15.2	**

Table 13. Milk yield, milk composition, components yield and utilization effectivity of nutrients from diets.

extruded rapeseed cake (Rapeseed), extruded full fat soybean (Soybean)

Item	Unit	Rapeseed		Soybean		Differ.	P[1]
		Mean	SEM	Mean	SEM	(%)	(n=36)
Milk yield	$kg.day^{-1}$	21.8	0.2	23.8	0.2	-9.4	***
Protein	%	3.21	0.04	3.17	0.03	1.1	NS
Protein yield	$g.day^{-1}$	697	10	755	9	-8.2	***
Fat	%	4.05	0.10	3.61	0.11	10.8	***
Fat yield	$g.day^{-1}$	886	26	860	27	2.9	NS
FCM[2]	$kg.day^{-1}$	22.0	0.5	22.4	0.4	-2.0	NS
FCM/DMI[2]	$kg.kg\ DMI^{-1}$	1.18	0.02	1.20	0.03	-1.4	NS
FCM/CPI[2]	$kg.kg\ CPI^{-1}$	9.35	0.18	9.44	0.23	-1.0	NS
PY/CPI[2]	$g.kg\ CPI^{-1}$	298	6	317	4	-6.4	***

[1] NS nonsignificant, * P<0.05, ** P<0.01, *** P<0.001

[2] FCM- 4 % fat corrected milk yield, FCM/DMI- FCM corrected for DMI, FCM/CPI- FCM corrected for CP intake, PY/CPI- protein yield corrected for CPI

Conclusions

- Extruded rapeseed cake had higher content of Met in total AA
- Extruded full fat soya had higher concentration of nutrients
- Content of Met, Lys and His was slightly belong optimum at both of diets (it could decreased milk yield)
- Total sum of AA and sum of nonessential AA in jugular plasma were sig. lower at group fed extruded rape cakes
- Content of fat in milk was sig. higher at group fed extruded rape cakes
- Milk yield, protein yield and protein yield corrected for crude protein intake was sig. lower at group fed extruded rape cakes