Effects of feeding high- and low-fibre fractions of air-classified, solvent-extracted canola meal on diet nutrient digestibility and growth performance of weaned pigs

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Background

- Canola meal is the second most world-traded supplemental protein meal after soybean meal for animal feeding.
- The nutritional value of canola meal is limited by its relatively high fibre content.
  - Fibre content reduces its energy value and the energy density of diets including canola meal, which can affect pig growth.
  - Fibre also reduce the extent of digestibility of other nutrients.
  - Due to its fibre content, canola meal has a lower energy value and amino acid digestibility compared to soybean meal.
- Means to reduce the fibre content of solvent-extracted canola meal include processing.
- Air-classification is a constant, dry fractionation process that separates air-suspended canola meal particles according to shape and mass yielding 2 distinct fractions.
- The light particle fraction has reduced fibre and somewhat enriched protein content. The heavy particle fraction has enriched fibre and somewhat reduced protein content.

Hypothesis

- Feeding the air-classified light and heavy fractions of *B. napus* and *B. juncea* canola meal could improve and worsen, respectively, nutrient digestibility and growth performance of weaned pigs compared with feeding the parent meals.

Objectives

- To determine diet apparent total tract digestibility (ATTD) of gross energy, crude protein, and dry matter.
- To compare the growth performance of weaned pigs fed canola parents meals or their air-classified fractions.

Materials and Methods

Milling and Air Classification of Parent Meals

Fig 1. Mikro-ACM15 Mill

Fig 2. Alpine ATP200 Air Classifier

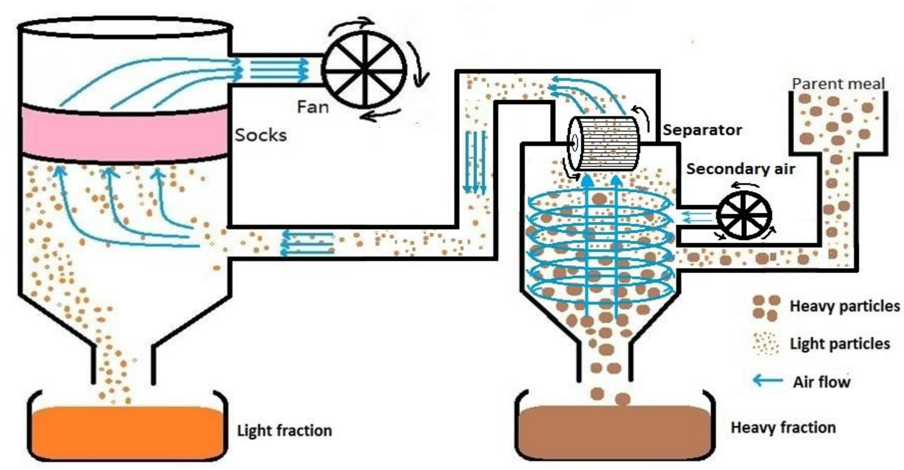

Fig 3. Air classification process

Test Ingredients

Table 1. Chemical composition of parent and air-classified canola meal

Nutrient, %	*B. napus*			*B. juncea*		
	Parent meal	Light fraction	Heavy fraction	Parent meal	Light fraction	Heavy fraction
Moisture	10.5	7.7	8.3	11.1	7.8	8.5
Crude protein	39.2	41.9	37.3	38.4	41.0	37.2
Crude fat	2.2	4.1	2.1	1.8	3.2	1.7
Crude fibre	9.7	0.3	8.7	6.8	0.4	8.3
ADF	20.1	13.1	25.6	12.9	8.6	16.5
NDF	27.2	20.6	31.5	20.4	13.6	23.5
Glucosinolates, μmol/g	6.4	4.7	3.9	11.7	9.8	9.0

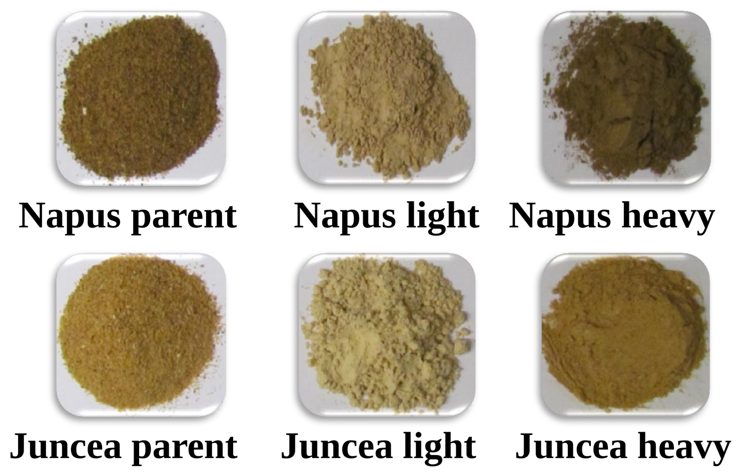

Fig 4. Parent and air-classified canola meal fractions

Phase Test Diets

Table 2. Ingredient composition of Phase 2 diets fed from d 0 to 9

Ingredients, %	Diet A	Diet B	Diet C	Diet D	Diet E	Diet F
Wheat, ground	45.85	45.95	45.92	45.81	45.80	45.87
***B. napus* parent meal**	**20.00**					
***B. napus* light fraction**		**20.00**				
***B. napus* heavy fraction**			**20.00**			
***B. juncea* parent meal**				**20.00**		
***B. juncea* light fraction**					**20.00**	
***B. juncea* heavy fraction**						**20.00**
Lactose	10.00	10.00	10.00	10.00	10.00	10.00
Soybean meal	5.00	5.00	5.00	5.00	5.00	5.00
Nutri-Pea Propulse field pea isolate	2.50	2.50	2.50	2.50	2.50	2.50
Soy protein concentrate HP300	2.50	2.50	2.50	2.50	2.50	2.50
Herring fish meal	2.50	2.50	2.50	2.50	2.50	2.50
Canola oil	7.00	7.00	7.00	7.00	7.00	7.00
Limestone	1.00	1.00	1.00	1.00	1.00	0.90
Mono-di-calcium phosphate	1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Premix	4.65	4.55	4.58	4.69	4.7	4.63
Analyzed nutrients, %						
Crude protein	24.44	24.65	23.55	24.18	24.46	23.94
Crude fibre	3.51	1.20	3.16	2.30	1.14	1.90
ADF	6.32	4.66	7.36	4.89	3.86	5.46
NDF	11.74	8.33	12.24	9.88	8.20	10.85

Table 3. Ingredient composition of Phase 3 diets fed from d 9 to 37

Ingredients, %	Diet AA	Diet BB	Diet CC	Diet DD	Diet EE	Diet FF
Wheat, ground	57.87	57.90	57.91	57.87	57.91	57.84
***B. napus* parent meal**	**20.00**					
***B. napus* light fraction**		**20.00**				
***B. napus* heavy fraction**			**20.00**			
***B. juncea* parent meal**				**20.00**		
***B. juncea* light fraction**					**20.00**	
***B. juncea* heavy fraction**						**20.00**
Soybean meal	12.50	12.50	12.50	12.50	12.50	12.50
Canola oil	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	1.00	1.10	1.00	1.00	1.00	1.00
Mono-di-calcium phosphate	0.75	0.72	0.77	0.75	0.70	0.75
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Premix	1.58	1.48	1.52	1.58	1.59	1.62
Celite 281	0.80	0.80	0.80	0.80	0.80	0.800
Analyzed nutrients, %						
Crude protein	23.56	24.14	23.57	23.49	23.93	23.88
Crude fibre	3.60	1.68	3.63	2.95	1.73	2.32
ADF	7.48	5.92	8.35	5.86	4.79	6.63
NDF	13.10	11.40	14.33	11.70	10.49	12.38

- Diets were formulated to contain 2.5, 2.4 Mcal NE/kg and 5.3, 4.8 standardized ileal digestible (SID) lysine/Mcal NE for Phase 2 and Phase 3, respectively.
- NE values of air-classified fractions were calculated using EvaPig®; SID coefficients used were established by Buchet et al., 2012 for the parent meals before.

Experiment Management

- 288 crossbred Hypor pigs were housed in 4 nursery rooms at SRTC, 2 barrows and 2 gilts per pen.
- Weaned (~19d of age) pigs were fed a common Phase 1 diet for 5d and started on trial at ~7kg BW.
- Test Phase 2 and 3 diets were offered ad libitum from Day 0 to 9 and Day 9 to 37, respectively.
- Individual pigs were weighed weekly. Pen feed added and weekly-end weighbacks were recorded.
- Pen faecal samples were collected on Day 17, 18.

Fig 5. Pens of pigs within block (representing areas within room) were randomly allocated to be fed one of 6 diet regimens during the 37-day study at SRTC

Results and Discussion

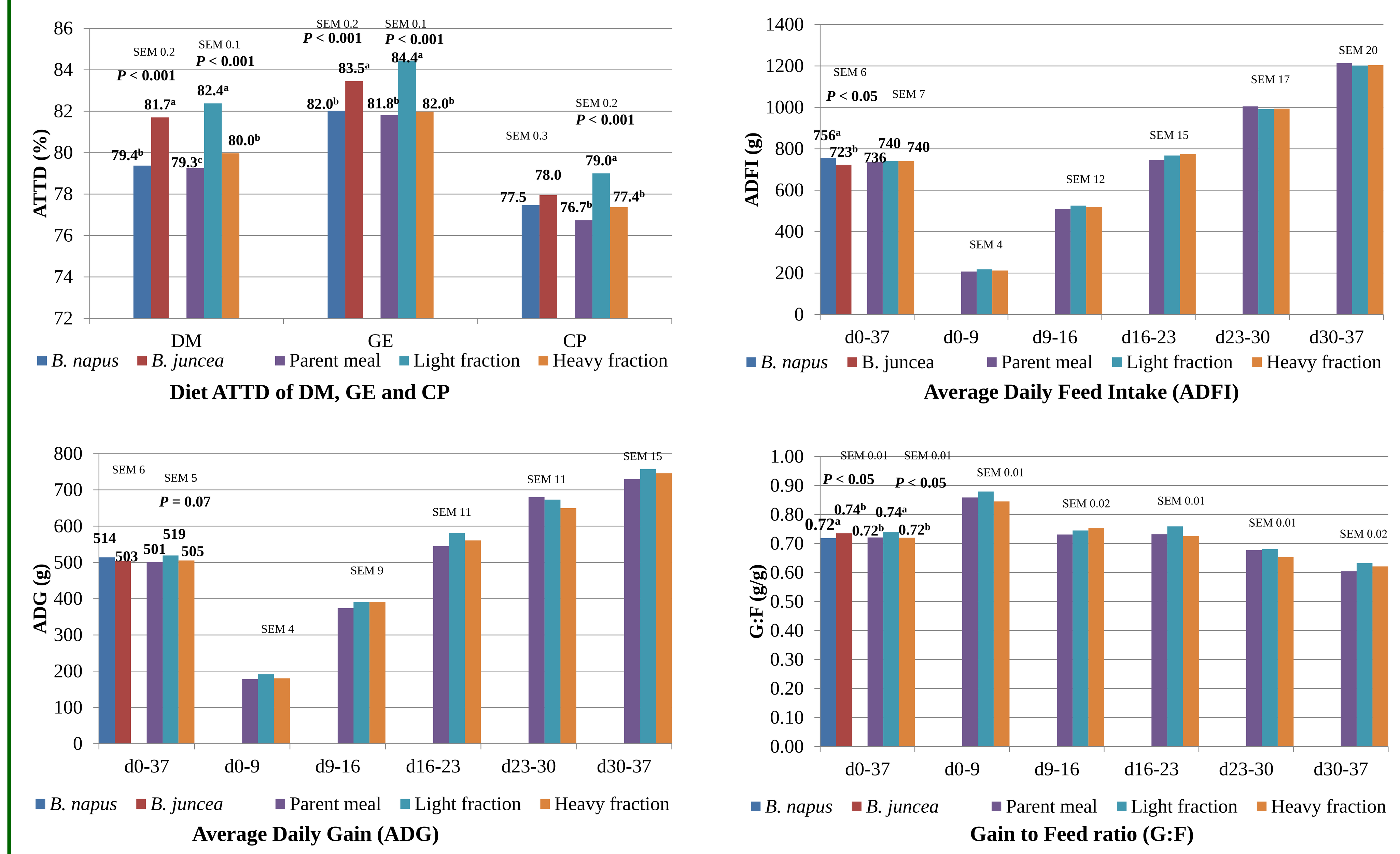

Fig 7. Effects of feeding *B. napus*, *B. juncea* canola meal and their air-classified fractions on ATTD of DM, GE and CP, and on weekly and overall growth performance of weaned pigs

- For both diet nutrient digestibility and growth performance, no interaction ($P > 0.10$) was found between feeding the canola species and parent meals or air-classified fractions.
- Feeding *B. juncea* resulted in greater ATTD of DM and GE compared to *B. napus*, which can be attributed to the thinner seed coat. Feeding the light fractions increased the ATTD of DM, GE and CP compared to the parent meals and heavy fractions, which can be explained by the reduced fibre content of the light fractions.
- Pigs fed *B. juncea* had overall lower ADFI than pigs fed *B. napus* because of higher glucosinolate content in *B. juncea* that likely depressed feed intake. No difference in ADFI was found among pigs fed different air-classified fractions.
- Feeding the light fractions resulted in 19g/d ADG improvement compared to feeding the parent meals.
- Pigs fed *B. juncea* had greater G:F than pigs fed *B. napus*, which can be explained by the lower fibre content of *B. juncea* improving diet digestibility. Pigs fed the light fractions had higher G:F than those fed either the parent or the heavy fractions because of reduced fibre content as well as smaller particle size.

Conclusion

- Air classification reduced the fibre content and enhanced the nutritional value of canola meal. Compared to the parent meals, feeding the low-fibre fractions improved diet ATTD of DM, GE and CP, but only had a minor effect on growth performance of weaned pigs.

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