

Screw-pressed *Camelina sativa* meal as feedstuff for broilers: Effects of graded dietary inclusion on organ weights and post-mortem signs of toxicity

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Introduction

Camelina sativa (a.k.a. false flax) is an oilseed (~37% oil) belonging to the *Brassica* family and is closely related to mustard, canola and rapeseed. Although it has been cultivated since the Bronze Age, there is recent interest as a food source of omega-3 fatty acids, as well as for bio-diesel production.

The major obstacle to expand camelina production and use is that the meal and oil resulting from crushing are not registered in Schedule IV of the Canadian *Feeds Act* as a feedstuff for livestock or poultry. To obtain registration as a feedstuff, the SAFETY and EFFICACY of the product must first be demonstrated. Like other *Brassica* species, camelina is known to contain antinutritional compounds which could adversely impact the health and/or productivity of poultry. These include (but may not be limited to) glucosinolates, erucic acid, sinapine and condensed tannins.

The objective of the present study therefore was to determine the effect of increasing dietary inclusion of screw-pressed *Camelina sativa* meal (CAM; 17% residual oil, 34% CP) on occurrence of likely clinical signs of toxicity and weight of selected organs in growing broilers at 14, 28 and 42 d of age.

Methods and Materials

Male broilers (Ross 308; n=725) housed in battery cages were fed diets containing 0, 8, 16 or 24% CAM for 42-d in a RCB design with 6 replicate cages per treatment. Diets in each of 3 growth phases (d 0-14, d 14-28, d 28-42) consisted of 76% of a phase-specific concentrate and cornstarch in reciprocal amounts to CAM to comprise the remaining 24%.

Six birds from each cage were removed on each of d 14, 28 and 42 of the experiment. On each of these days, 3 of these birds were euthanized by injection to preserve the integrity of the thyroid and were sent intact for post-mortem examination by a veterinary pathologist (who was blind to treatment). The other 3 birds removed on each day were euthanized by cervical dislocation and dissected to remove selected organs, which were weighed.

Organ weights were analyzed using PROC MIXED of SAS 9.1, with CAM inclusion as fixed effect, block as the random term, and BW as a covariate. Organ weight data were also analyzed for linear and quadratic effects of camelina meal inclusion. Results of post-mortem examinations were analyzed using PROC CATMOD of SAS 9.1.

Results

Increasing dietary inclusion of CAM affected organ weights (Table 1).

Increasing dietary CAM inclusion linearly reduced liver wt, but only at 14 d of age ($P < 0.01$). Heart wt increased by 4% for each 8% increase in dietary CAM inclusion, but only at 28 d of age (linear; $P < 0.02$). For each 8% incremental increase in dietary CAM inclusion, pancreas wt increased by 27 and 21% at 28 and 42-d of age, respectively (linear; $P < 0.01$).

Table 1. Effect of increasing dietary inclusion of screw-pressed *Camelina sativa* meal on selected organ weights of broilers at 14, 28 and 42 d of age.

	Camelina meal inclusion, %				SEM	P - value		
	0%	8%	16%	24%		Level	Linear	Quad
Body Wt, g								
d 14	355	385	371	375	12	0.382	-	-
d 28	1148 ^b	1378 ^a	1377 ^a	1240 ^b	46	0.001	0.189	0.001
d 42	2070 ^c	2427 ^{ab}	2667 ^a	2318 ^{bc}	87	0.001	0.010	0.001
Liver, % of BW								
d 14	3.89 ^a	3.57 ^b	3.40 ^b	3.39 ^b	0.08	0.001	0.001	0.064
d 28	3.05	3.06	2.89	2.91	0.09	0.307	-	-
d 42	2.49	2.68	2.44	2.47	0.09	0.193	-	-
Heart, % of BW								
d 14	0.70	0.74	0.68	0.70	0.03	0.328	-	-
d 28	0.64 ^b	0.68 ^{ab}	0.71 ^a	0.70 ^a	0.02	0.051	0.016	0.194
d 42	0.60	0.59	0.61	0.63	0.02	0.600	-	-
Pancreas, % of BW								
d 14	0.39	0.46	0.43	0.45	0.02	0.088	-	-
d 28	0.22 ^c	0.27 ^c	0.33 ^b	0.40 ^a	0.02	0.001	0.001	0.540
d 42	0.17 ^c	0.19 ^c	0.24 ^b	0.28 ^a	0.01	0.001	0.001	0.366

There was no evidence relationship between dietary CAM inclusion level and frequency of post-mortem findings that might suggest toxicity of CAM (Table 2).

A significantly higher occurrence of tibial dyschondroplasia was observed for 16 and 24% CAM diets compared to the 0 and 8% inclusion diets ($P < 0.001$, data not shown), however this may be due to mineral imbalances or higher growth rate resulting from the substitution of cornstarch for CAM in test diets.

Table 2. Effect of increasing dietary inclusion of screw-pressed *Camelina sativa* meal on frequency on likely post-mortem indicators of toxicity at 14-, 28- and 42-d of age¹.

	Camelina meal inclusion, %				P - value Level
	0%	8%	16%	24%	
Ascites					
d 14	0	0	0	0	> 0.999
d 28	0	0	0	0	> 0.999
d 42	0	0	1	1	0.801
Right Ventricular Dilation					
d 14	0	0	0	0	> 0.999
d 28	0	0	0	0	> 0.999
d 42	0	2	1	0	0.432
Left Ventricular Dilation					
d 14	0	0	0	0	> 0.999
d 28	0	0	0	0	> 0.999
d 42	0	2	0	0	0.392
Pericarditis					
d 14	0	0	0	0	> 0.999
d 28	0	0	0	0	> 0.999
d 42	0	0	0	0	> 0.999
Thyroid enlargement					
d 14	0	0	0	0	> 0.999
d 28	0	1	0	1	0.801
d 42	0	0	0	0	> 0.999

¹ Based on post mortem examination of 18 birds/treatment on each sampling day

Conclusions

Observed changes in organ wt in this study are consistent with differences in digestible protein and fat content among test diets and do not suggest toxic effects of CAM inclusion in broiler diets. Absence of toxic effects of CAM inclusion up to 24% is further supported by the lack of pathological post-mortem cardiac or thyroid morphology.

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