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Feeding *Camelina Sativa* and Enhancing Omega-3 Fatty Acid Levels in Market-age Turkey Hens

David Frame, USU Poultry Specialist
Matt Palmer, Agricultural Agent, Sanpete County Extension
Robert Ward, USU Food & Nutrition
Silvana Martini, USU Food & Nutrition

Executive Summary

Introduction

Camelina sativa (L.) Crantz (camelina) is an oilseed producing plant in the Family Brassicaceae (Cruciferae) originating from the Mediterranean to Central Asia.

There is increasing interest in converting waste cooking oil and oil produced from oilseed crops, such as camelina, into biofuels in order to decrease dependence on petroleum products for fuel sources. The interest for growing oilseed crops in Utah is growing as well. *Camelina sativa* is a low input oilseed-producing crop adapted to climates similar to central Utah. Central Utah is also home to the Utah commercial turkey industry.

Camelina meal (CM) is the by-product of camelina oil extraction and has a crude protein content similar to canola meal. If growing camelina becomes a viable crop in central Utah, the use of CM in turkey diets would further increase the value of the crop.

Additionally, studies show that oil content of the seed ranges from 37 to 41 percent, and is reported to be high in omega-3 fatty acids. Medical research asserts that a diet abundant in omega-3 fatty acids (FAs) is beneficial to human cardiac health. Research in other animals has shown that omega-3 FAs transfer from animal feed into consumer products.

Objective

The purposes of this study were to 1) look at the feasibility of using CM as a feed ingredient for turkey diets and 2) determine if feeding CM increased the content of omega-3 FAs in turkey meat, thereby creating the possibility of a niche market for omega-3-enriched turkey products. The results contained in this report come from research conducted at the Utah Agricultural Experiment Station (Turkey Research Facility) in Ephraim, Utah.

Potential Benefits to the Turkey Industry

- Locally-produced high protein, high fat feed ingredient for turkeys
- High omega-3 FA content may be exploited as a specialty niche market in turkey meat production

Nutrient Content of Camelina Meal

Our tests show that CM is a viable feed ingredient for turkeys if cost and availability are feasible. Tables 1 and 2 summarize our findings of nutrient content of CM. Analysis of the CM that was done at the University of Arkansas Poultry Science Central Analytical Laboratory, Fayetteville, AR.

Table 1. Selected nutrient and mineral content of camelina meal. (Mean value)

Dry Matter (%)	98.0
Protein (%)	33.0
Fat (%)	17.8
Calcium (ppm)	2597
$Phosphorus_{(tot)}$ (ppm)	12231
Potassium (ppm)	14879
Sodium (ppm)	17.6
Chloride (ppm)	18.7

Table 2. Limiting amino acid profile of camelina meal. (Mean value)

	(%)*
Arginine	2.72
Cystine	1.07
Lysine	1.56
Methionine	0.95
Threonine	1.23
Tryptophan	0.34

* Percent of camelina meal on an as-fed basis

Live Production Performance

A diet containing 10% CM was fed to hens from 9 weeks of age through processing (13.5 weeks old). Integrating CM into the diet did not significantly alter weight gain. Feed conversion ratios were similar. (See Table 3.)

Table 3. Live production results of hens: Ending weight at processing age, weight gain between 9 weeks and processing age (13.5 weeks), and feed conversion between 9 and 13.5 weeks of age.

	Ending weight (kg)	Weight gain (kg)	Feed conversion ratio
Control	7.7	3.4	2.40
CM (10%)	7.6	3.3	2.36

Results of Consumer Test

Two consumer tests for "degree of liking" of turkey breast and thigh were performed at the Utah State University Food and Nutrition Department, Logan, Utah. A control (breast and thigh from hens fed with regular feed until processing) and treated sample (breast and thigh from hens fed with 10% CM diet for the final four weeks before processing) were presented simultaneously to 120 consumers. A 9-point Hedonic scale was used for degree of liking of each breast and thigh sample (size of each sample was one cubic inch). The scale ranged from 1 meaning dislike extremely to 9 meaning like extremely. Samples were grilled to reach an internal cooking temperature of 165 °F and were served warm.

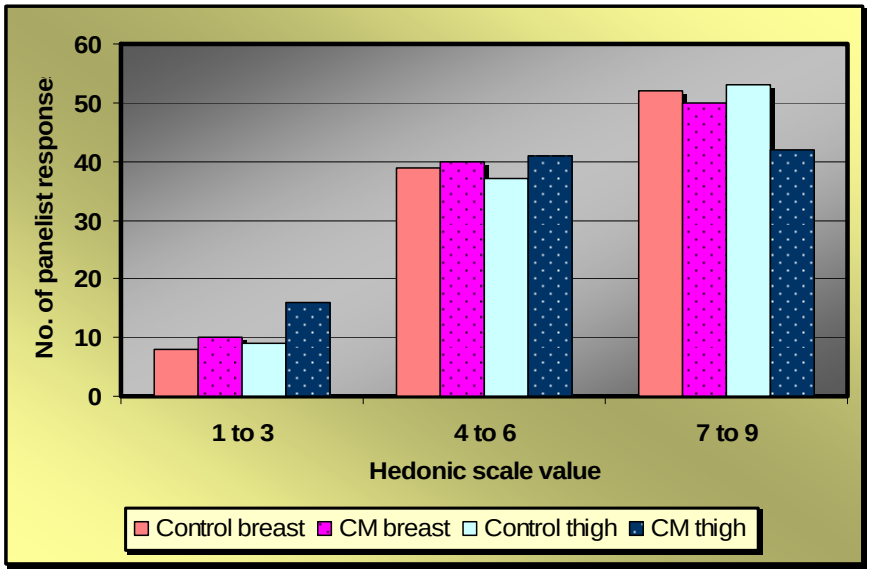
Table 4 and Figure 1 summarize the results obtained from these tests. There were no significant differences in degree of liking between the control and the treatment meats ($p<0.05$).

Table 4. Degree of liking (DL)* for breast and thigh meat from turkeys fed camelina meal (CM) and turkeys receiving the control diet – reported as mean DL ± 1 standard deviation from the mean (n = 120).

	Breast meat		**Thigh meat**	
	Control	**CM**	**Control**	**CM**
DL	6.16 ± 1.73	5.98 ± 1.75	5.88 ± 1.93	5.67 ± 1.84
p-value	0.3215		0.2234	

*Each panelist recorded his/her impressions of the meat by rating it on a scale of 1 to 9: 1 = extremely dislike and 9 = extremely like.

Figure 1. Rating frequency (on a scale of 1 to 9) for breast and thigh meat from turkeys fed CM and turkeys receiving the control diet.



Omega-3 Content of Meat

Two particular omega-3 FAs important to human health were evaluated: Alpha-linolenic acid (ALA) and docosahexaenoic acid (DHA). Feeding a diet containing 10% CM significantly ($p < 0.01$) elevated the content of both ALA and DHA in breast and thigh meat compared to controls. (Table 5)

Table 5. Selected omega-3 FA content of hen breast and thigh meat after four weeks of receiving a 10% CM diet vs. control diet. (mg of FA/g dried tissue; mean ± 1 std.)

	ALA* C18:3(n-3)		DHA** C22:6(n-3)	
	Control	CM	Control	CM
Breast	0.36 ± 0.25	1.07 ± 0.43	1.36 ± 0.31	2.56 ± 0.52
Thigh	0.74 ± 0.37	2.36 ± 1.29	2.35 ± 0.31	3.34 ± 0.73

*Alpha-linolenic acid
**Docosahexaenoic acid

Conclusions

- Camelina meal was fed at a dietary level of 10% to hens without significantly altering weight gain ($p < 0.05$) or increasing feed conversion ratio.
- Feeding camelina meal imparted no significant difference in "degree of liking" of breast or thigh meat in a consumer test.
- Feeding camelina meal significantly increased ($p < 0.01$) omega-3 FA concentration in both breast and thigh meat compared to control group.

Acknowledgement

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