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Comparison of Soybean Oil with an Animal/Vegetable Blend at Four Energy Levels in Broiler Rations from Hatch to Market

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Abstract: Soybean oil and an animal/vegetable blend were fed on an equal metabolizable energy basis to Cobb broilers over a seven week period in a commercial style, litter floored, curtain sided building in order to determine if there were any differences between the two fat sources when comparing feed intake, gain and feed:gain. All of the birds were fed a diet that consisted primarily of corn, soybean meal and animal by-product meal. There were three dietary phases with each phase having four increasing ME levels through increased fat content. Each phase had eight diets that were fed to 30 birds per pen with six replicates each. Birds and feed were weighed on days 21, 35 and 49 with processing for yield on day 50. The data shows that as the dietary fat increased, in some cases the birds consumed less feed and showed improved feed:gain. Body weight gain was not significantly different, however.

Key words: Soybean oil, broilers diet, dietary fat

INTRODUCTION

The use of added fat as a method of increasing energy has a long history in the poultry industry. Previous research has shown no differences in performance when broilers were fed different fat sources to market weight (Firman *et al*., 2008). Pesti *et al*. (2002) found no significant differences between different fat sources when fed to young broilers. When animal tallow is added to feed at a low level, it may be beneficial to blend it with a small amount of vegetable oil. The resulting ME_n value of the blends is greater than can be explained from the arithmetic combination (National Research Council, 1994). A synergism in the absorption of the saturated fatty acids related to the added amounts of unsaturated fatty acids is suspected (Ketels *et al*., 1986; Ketels and DeGroote, 1987). High-level fat feeding evidently increases the intestinal retention time of feed and so allows for more complete digestion and absorption of the nonlipid constituents (Mateos and Sell, 1981a; Mateos and Sell, 1981b; Sell *et al*., 1983). This study was designed to test two sources of fat (soybean oil and animal vegetable blend) at different levels to determine if there are differences in performance between a vegetable source and a blend at different energy levels.

MATERIALS AND METHODS

Soybean oil and an animal/vegetable blend were compared in this study. The two fats were fed at four different levels with base energy set at 3075, 3125 and 3175 kcal/kg respectively for the three different dietary stages. Energy was increased in 100 kcal/kg increments to make up the four energy treatments. Eight treatments with six replicate pens of birds, with 35 birds per pen, were utilized in a 2 x 4 factorial, blocked by location within the facility. Each block then had the treatments randomized within the block. Cobb straight run chicks were housed and raised under simulated industry conditions in a curtain-sided building. The birds received a lighting schedule of 23 h of light and one hour of darkness. Birds were allowed feed and water *ad libitum*. Birds were weighed and feed intake was quantitated at 21, 35 and 49 days of age with processing and cut-up for yield at 50 days of age. Diets consisted primarily of corn, soybean meal and animal by-product meal. All diets met or exceeded NRC specifications. All procedures were conducted in accordance with our standard operating procedures and the University of Missouri Animal Care and Use Committee under an approved protocol.

There were eight treatments that consisted of Soybean Oil (positive control) at four different Metabolizable Energy (ME) levels and animal/vegetable blend at the same four energy levels. Both fats were obtained from commercial facilities. Diets were least cost computer formulated and are shown in Table 1.

On days 21, 35 and 49, birds were weighed as a pen and feed consumption was calculated. Mortality was collected daily for adjusted feed conversion. A feed to gain ratio was determined for each pen. Four birds, two males and two females, were selected from each pen on day 49 based on average pen weight to be processed for yield data on day 50. After processing, weights were collected for the whole bird hot and cold, the leg, wing, thigh, fat pad, pectorals major and pectorals minor. All data were analyzed by two-way analysis of variance. Means were then separated with an LSD test where appropriate. Generally, block effects are not significant and this portion of the variance was added into the error mean square. All data was analyzed using the JMP version of SAS™. The level of significance was set at 5%.

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Table 1: Composition of experimental diets

	Trmt 1-4 Starter 0-3 wk				Trmt 1-4 Grower 3-5 wk				Trmt 1-4 Finisher 5-7 wk			
Ingredients	1	2	3	4	1	2	3	4	1	2	3	4
ME (kcal/kg)	3075	3175	3275	3375	3125	3225	3325	3425	3175	3275	3375	3475
Ground corn	58.56	56.11	53.67	51.22	65.56	62.74	60.31	57.44	70.17	67.72	65.28	62.83
Soybean meal	29.50	29.86	30.22	30.58	24.81	25.23	26.12	27.17	21.17	21.53	21.89	22.25
Porkmeal	8.456	8.485	8.514	8.544	6.074	6.097	5.639	5.101	4.932	4.961	4.990	5.020
Avatec	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Baciferm	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Trace mineral premix[1]	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Choline chloride	0.070	0.071	0.072	0.072	0.000	0.000	0.000	0.000	0.017	0.018	0.019	0.020
Copper sulfate	0.010	0.010	0.010	0.010	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Dicalcium phosphate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DL-methionine	0.123	0.125	0.127	0.129	0.039	0.041	0.043	0.046	0.003	0.005	0.007	0.009
Fat	2.392	4.454	6.516	8.578	2.221	4.593	6.445	8.624	2.356	4.418	6.480	8.542
Salt	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Sodium bicarbonate	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Vitamin premix[2]	0.080	0.080	0.080	0.080	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075
Selenium premix[3]	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Lime stone	0.128	0.119	0.110	0.101	0.521	0.512	0.566	0.630	0.582	0.573	0.564	0.555

[1]Trace mineral premix analysis: Ca 2.50%, Fe 6.0%, Mg 2.68%, Mn 11.0%, Zn 11.0%, I 2,000 ppm.
[2]Vitamin premix provided per kilogram of diet: vitamin A 1,500 IU, D 200 IU, E 10 IU, K 2 mg, Thiamin 1.8 mg, Riboflavin 4.5 mg, Pyridoxine 3.5 mg, Folic acid 0.55 mg, Miacin 35, mg, Pantothenic acid 14 mg, Choline 1,300 mg.
[3]Selenium premix analysis: Ca 36.08%, Se 0.06%. [4]All values are as a percent of the diet except ME which is calculated as (Kcal/kg)

Table 2: Energy values for each treatment per phase

Treatments corresponding to energy level	0-3 Week	3-5 Week	5-7 Week
1-5	3075	3125	3175
2-6	3175	3225	3275
3-7	3275	3325	3375
4-8	3375	3425	3475

Table 3: Broiler gain per phase

	0-3 Week (kg/bird/phase)		3-5 Week (kg/bird/phase)		5-7 Week (kg/bird/phase)	
Energy level	Soybean oil	A/V blend	Soybean oil	A/V blend	Soybean oil	A/V blend
1	0.72	0.73	1.20^{A}	1.18^{A}	1.37	1.34
2	0.74	0.74	1.14^{A}	1.16^{A}	1.40	1.35
3	0.73	0.71	1.05^{B}	1.17^{A}	1.30	1.43
4	0.70	0.72	1.05^{B}	1.18^{A}	1.33	1.40

[1]Means in the same column bearing different superscripts are significantly different ($p<0.05$)

Table 4: Broiler gain for the 3, 5 and 7 week growth periods

Energy source	Treatment	0-3 Week (kg/bird/phase)	0-5 Week (kg/bird/phase)	0-7 Week (kg/bird/phase)
Soybean oil	1	0.72	1.91^{A}	3.28
	2	0.74	1.88^{AB}	3.28
	3	0.73	1.78^{BC}	3.08
	4	0.70	1.74^{C}	3.07
Animal/vegetable blend	5	0.73	1.90^{A}	3.24
	6	0.74	1.90^{AB}	3.24
	7	0.71	1.88^{AB}	3.31
	8	0.72	1.89^{AB}	3.28

[1]Means in the same column bearing different superscripts are significantly different ($p<0.05$)

RESULTS AND DISCUSSION

Treatments are shown in Table 2. Results of the trial can be found in Tables 3-9. Feed intake was unchanged during the starter period, but decreased in the 3-5 week phase as energy increased. In the 5-7 week period, no differences were seen in the animal/vegetable blend while the highest soybean oil levels resulted in decreased feed intake. Overall, feed intake decreased with increasing energy with both oil sources at 5 and 7 weeks of age. No differences in gain were seen in the animal/vegetable blend treatments, but gain in the soybean oil treatment mirrored the decreased feed

Table 5: Broiler feed intake per phase

Energy level	0-3 Week (kg/bird/phase)		3-5 Week (kg/bird/phase)		5-7 Week (kg/bird/phase)	
	Soybean oil	A/V blend	Soybean oil	A/V blend	Soybean oil	A/V blend
1	1.07	1.08	2.04^{A}	2.08^{A}	3.03^{A}	3.01
2	1.07	1.09	1.98^{AB}	2.03^{A}	2.98^{A}	3.02
3	1.06	1.07	1.89^{BC}	2.01^{AB}	2.79^{B}	3.01
4	1.05	1.06	1.79^{C}	1.98^{AB}	2.79^{B}	2.99

[1]Means in the same column bearing different superscripts are significantly different (p<0.05)

Table 6: Broiler feed intake for the 3, 5 and 7 week growth periods

Energy source	Treatment	0-3 Week (kg/bird/phase)	0-5 Week (kg/bird/phase)	0-7 Week (kg/bird/phase)
Soybean oil	1	1.07	3.12^{AB}	6.15^{A}
	2	1.07	3.04^{ABC}	6.02^{A}
	3	1.06	2.94^{BC}	5.73^{B}
	4	1.05	2.84^{C}	5.62^{B}
Animal/vegetable blend	5	1.08	3.16^{A}	6.16^{A}
	6	1.09	3.12^{AB}	6.14^{A}
	7	1.07	3.09^{AB}	6.09^{A}
	8	1.06	3.04^{AB}	6.03^{A}

[1]Means in the same column bearing different superscripts are significantly different (p<0.05)

Table 7: Means for the adjusted feed:gain ratios per bird for the 3, 5 and 7 week growth period

Energy level	0-3 Week (kg:kg)		3-5 Week (kg:kg)		5-7 Week (kg:kg)	
	Soybean oil	A/V blend	Soybean oil	A/V blend	Soybean oil	A/V blend
1	1.51	1.50	1.72	1.78	2.21^{A}	2.26^{A}
2	1.44	1.48	1.74	1.77	2.15^{AB}	2.16^{AB}
3	1.42	1.51	1.79	1.73	2.11^{BC}	2.10^{BC}
4	1.51	1.60	1.71	1.71	2.08^{C}	2.01^{C}

[1]Means in the same column bearing different superscripts are significantly different (p<0.05)

Table 8: Adjusted feed:gain ratios for the 3, 5 and 7 week growth periods

Energy source	Treatment	0-3 Week (kg:kg)	0-5 Week (kg:kg)	0-7 Week (kg:kg)
Soybean oil	1	1.51	1.64	1.87^{AB}
	2	1.44	1.62	1.84^{BC}
	3	1.42	1.63	1.83^{BC}
	4	1.51	1.63	1.82^{C}
Animal/vegetable blend	5	1.50	1.67	1.91^{A}
	6	1.48	1.65	1.86^{AB}
	7	1.51	1.65	1.84^{BC}
	8	1.60	1.67	1.81^{C}

[1]Means in the same column bearing different superscripts are significantly different (p<0.05)

Table 9: Day 50 processing and yield data

Energy source	Treatment	Live Wt. (kg)	Hot carcass (g)	Fat pad (g)	Cold carcass (g)	Leg (g)	Thigh (g)	Wing (g)	Maj. Breast (g)	Min. Breast (g)
Soybean oil	1	3150	2208	72	2341^{B}	158	191	134	282^{A}	58^{A}
	2	3270	2311	79	2114^{B}	151	176	121	245^{B}	48^{B}
	3	3110	2177	73	2336^{B}	163	195	129	281^{AB}	55^{AB}
	4	3030	2293	78	2369^{A}	165	195	135	285^{A}	59^{A}
Animal/	5	3200	2242	71	2362^{B}	164	196	134	288^{A}	55^{AB}
vegetable	6	3150	2139	80	2284^{B}	161	190	129	272^{AB}	54^{AB}
blend	7	3190	2220	82	2379^{A}	165	196	135	289^{A}	55^{AB}
	8	3180	2218	82	2261^{B}	159	186	129	267^{AB}	55^{AB}

[1]Means in the same column bearing different superscripts are significantly different (p<0.05)

intake in the 3-5 week and was reduced. The reason for this is unclear and appears to be an anomaly. Overall, few differences in gain were seen as a decreased feed intake resulted in little effect on overall gain. Feed efficiency was not affected until the finisher period when it was linearly improved with energy addition. By the conclusion of the trial feed efficiency was improved by as much as 5.5% while energy was increased by

approximately 9% in these diets. No consistent differences were seen in any of the processing parameters measured.

The findings of this study were generally consistent with expected norms in that birds fed more energy decreased feed intake, maintained similar gain and slightly improved feed efficiency. The benefits of fat addition appeared to occur after the first weeks in life as has been reported previously (Sibbald, 1978; Lessire *et al*., 1982). Birds on these diets consumed more energy when fed higher energy diets (Potter and McCarthy, 1985), but feed efficiency did not improve as much as would be expected by the energy addition. This would lead to the conclusion that energy additions may not be a cost effective way to improve feed efficiency.

REFERENCES

Firman, J.D., A. Kamyab and H. Leigh, 2008. Comparison of fat sources in rations for broilers from hatch to market. Int. J. Poult. Sci., 7: 1152-1155.

Ketels, E.G. and G. DeGroote, 1987. Effect of fat source and level of fat inclusion on the utilization of fatty acids in broiler diets. Arch. Gefluegelkd., 51: 127.

Ketels, E.G., G. Huyghebaert and G. DeGroote, 1986. The nutritional value of commercial fat blends in broiler diets. 2. Effect of the incorporation level on the fatty acids utilization. Arch. Gefluegelkd., 51: 65.

Lessire, M.B., B. Lecleroq and L. Conan, 1982. Metabolizable energy value of fats in chicks and adult cockerels. Anim. Feed Sci. Tech., 7: 365.

Mateos, G.G. and J.L. Sell, 1981a. Metabolizable energy of supplemental fat as related to dietary fat level and methods of estimation. Poult. Sci., 60: 1509-1515.

Mateos, G.G. and J.L. Sell, 1981b. Nature of the extrametabolic effect of supplemental fat used in semipurified diets for laying hens. Poult. Sci., 60: 1925.

National Research Council, 1994. Nutrient Requirements of Poultry, 9th Rev. Edn., National Academy Press. Washington, DC.

Pesti, G.M., R.I. Bakalli, M. Qiao and K.G. Sterling, 2002. A comparison of eight grades of fat as broiler feed ingredients. Poult. Sci., 81: 382-390.

Potter, L.M. and J.P. McCarthy, 1985. Varying fat and protein in diets of growing large white turkeys. Poult. Sci., 64: 1941.

Sell, J.L., J.A. Eastwood and G.G. Mateos, 1983. Influence of supplemental fat on diet metabolizable energy and ingesta transit time in laying hens. Nutr. Rep. Int., 28: 487.

Sibbald, I.R., 1978. The effect of the age of the assay bird on the true metabolizable energy values of feeding stuffs. Poult. Sci., 57: 1008.