Final Report **Final Report Submission Date:** April 18, 2016

Submitted to: Fats and Proteins Research Foundation, Inc.

Project Title: High fat pre-starter rations for broilers

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Project Started: July 2015 **Project Completed:** July, 2016

INDUSTRY SUMMARY

Introduction:

The rendering industry produces significant quantities of rendered fats. Yellow grease is widely available and in many cases the cheapest fat source available for animal feeding. A variety of other rendered fats are also available. Fat use by the broiler industry has gone down in recent years as the cost of energy has climbed and typical ME levels have been lowered. In many cases, levels of fat fed are quite low with even finisher rations containing less than 3% added fat. The turkey industry continues to feed reasonably high levels of fat with some finisher rations containing as much as 6-8% added fat. However, the initially high protein levels fed preclude high energy levels during the starter period as most protein ingredients are low energy. Feeding high fat diets in the pre-starter period may improve starting of poults (always a problem) as well as increase fat utilization by the turkey industry. We would not anticipate any changes in the fat use in later diets by either the broiler or turkey industry. This research, if successful, would provide data on a new practice that has the potential to increase the use of fat in pre-starter rations. This could be as much as 200,000 tons of fat usage yearly in the US.

Objectives:

This project was designed to determine if high fat pre-starter rations would improve initial bodyweight of chicks and if the increases seen would be maintained to market weight.

Industry Summary:

Significantly improved feed conversion of broilers fed a high amount of dietary fat was observed at 10, 14, and 17 days of age. This effect was not maintained to market weight. At 49 days of age, high dietary fat inclusion during the pre-starter period did not significantly improve the measured growth parameters. From this study we can conclude that under normal, industry comparable conditions, high dietary fat inclusion in the pre-starter ration of broilers to 10 or 14 days is not advisable as it does not improve growth parameters at market. With no improvement seen at market, the added cost of fat in the pre-starter ration does not provide a substantial enough return to implement this strategy. Under more adverse conditions it is possible a greater effect would have been observed at market but it is unlikely the industry would adopt a practice that does not improve performance under normal conditions as observed in the present study.

In turkeys, few differences were seen in any of the parameters measured. Birds performed well reaching ~44 pounds at 20 weeks of age. No consistent differences were seen in body weight gain, feed/gain or feed intake. At the conclusion of the trial no differences in any parameters were noted. It would appear that early inclusion of fat at high levels does not result in performance benefits.

EFFECTS OF HIGH FAT BROILER PRE-STARTER

RATIONS ON PERFORMANCE AND COST

ABSTRACT

A 49 day experiment was conducted to test the addition of 6% or 8% yellow grease (YG) to diets of broilers during the 0-10 day or 0-14 day pre-starter period. Forty-eight pens of birds were fed one of 6 treatments to consist of a control (least cost addition of YG), 6% YG, or 8% YG, each fed to either 10 or 14 days. Eight replicate pens were used for each treatment arranged in a randomized complete block design with location as the blocking factor. Each pen contained 33 commercial strain broilers placed at hatch and raised to seven weeks of age. Diets consisted of commercial type corn-soy-DDGS-meat meal base and were adjusted to maintain a consistent relationship between energy and crude protein as well as amino acids. Birds were weighed and diets changed at 10 or 14 days, 17 days, or 35 days with completion of the trial at 49 days. Feed conversion was significantly improved by the addition of fat during the treatment period, a result of numerically higher body weight and reduced feed intake although neither was significant. Improved growth performance from the addition of fat during the treatment period did not result in improved performance at market, as no effects by dietary treatment were found at 49 days. Feeding a high plain of nutrition pre-starter ration to 14 days did improve feed conversion at 14 days. This effect was carried through to 49 days and similar body weights were observed. These results suggest the addition of high levels of fat in the pre-starter ration does not improve growth performance at 49 days.

INTRODUCTION

The first 2 weeks of life make up 28% of a typical broiler's life, slaughtered at 49 days, but only accounts for about 8.5% of total feed consumption (Cobb-Vantress, 2015). Lilburn (1998) and Ebling and coworkers (2015) agree that this separation gives nutritionists an opportunity to use more expensive ingredients to provide a higher plain of nutrition could improve performance during the first two weeks and should be seen as an investment rather than a cost. At current prices of about $220/ton and $200/ton in the pre-starter and finisher rations respectively, an 8% increase in the price of the pre-starter ration would have to occur to raise the total cost of feed/bird one cent (CME, 2015; Cobb-Vantress, 2015). This calculation would be assuming the increase in diet cost caused no improvements in feed efficiency and thus demonstrates the potential for cheaply improving the growth and efficiency of broilers.

Feed costs represent about 70% of the cost of poultry production (Willems et al., 2013). As the cost of feed continues to increase, improved feed conversion and reduced mortality become more valuable (Jiang et al., 1998; Donohue and Cunningham, 2009; Wood, 2009; Willems et al., 2013). For a broiler marketed at 49 days, about 50% of feed consumption occurs in the last two weeks resulting in about 50% of feed costs being incurred during this period (Cobb-Vantress, 2015). As the broiler grows older and larger, maintenance requirements increase causing a decline in feed conversion and increased feed consumption. This high amount of feed consumption later in life causes improved feed conversion to be very important economically and mortality to be expensive since the bird has already consumed so much feed. Optimizing nutrition during the first two weeks, with a practical disregard for cost, could improve gut health and insure birds develop to their maximum genetic potential. Ferket (2015) suggests under nutrition in the perinatal and immediate post-hatch nutrition are constraining development to support subsequent growth. With proper development and gut health during the immediate post-hatch period, when intense changes are occurring in the small intestine (Sklan, 2001), we may be able to improve feed conversion and reduce mortality later in the life of the bird as well as improve the final body weight (BW) of the bird at marketing.

Increased nutrient density via the use of high fat rations is a promising method for achieving optimal nutrition in the young chick. Traditionally, the young chicks ability to digest and absorb fats has been considered to be low (Renner and Hill, 1961; Carew et al., 1972; Krogdahl, 1985; Sell et al., 1986; Tancharoenrat et al., 2013). These studies have caused a dogma in poultry nutrition that fats should not be used in the diets of young chicks, but this is no reason to avoid fats since the young chick is outfitted for fatty acid metabolism (Lilburn, 1998), digestion improves rapidly (Firman, 2006), and total absorption of fat and energy increases with increased dietary fat inclusion (Noy and Sklan, 2001). Fat, starch, and amino acid digestibility are all lowest in the young chick during the first week and all improve with age (Noy and Sklan, 1995; Batal and Parsons, 2002; Thomas et al., 2008). The young chick also has a low capacity for feed consumption due to physical limitations. Utilization of a high nutrient density diets via the use of high dietary fat inclusion thus has the potential to increase total nutrient uptake in the young chick.

The primary objective of this experiment was to determine if high fat pre-starter rations could improve initial performance of chicks and if the observed increase would be maintained to market weight.

MATERIALS AND METHODS

General Procedures

To determine if industry growth standards could be improved, an experiment was conducted using as hatched Cobb/Cobb birds obtained from a commercial hatchery. Birds were housed and maintained according to the University of Missouri standard operating procedures and the University of Missouri Animal Care and Use Guidelines. Standard US corn-soy-DDGS-animal byproduct diets were used with the exception of the changes in yellow grease addition.

Trial Design

Forty-eight pens of broilers with 33 birds/pen for a total of 1,584 birds were used in a 2 x 3 factorial design with 6 treatments and 8 replicate pens. Treatments included a low fat pre-starter diet, 6% or 8% added fat (yellow grease) x 10 days and 14 days on diet. These diets were fed for either the 10 or 14 day period followed by industry standard diets through the remaining growout period with ration changes at 17 and 35 days. Each floor pen measured 4 feet wide and 8 feet deep, and contained one metal feeder, one nipple waterer with 5 nipples each 6 inches apart, one heat lamp, and new cedar shavings. Supplemental feed trays were used in each pen from 0 to 5 days to encourage acclimation to feed. Heat lamps were used during brood and removed at 14 days of age. Birds received continuous light throughout the trial.

Treatment Descriptions

Three experimental diets were fed representing 6 treatments with time fed being the other variable. Experimental diets consisted of an industry standard control diet (C), 6% added fat (YG6), or 8% added fat (YG8) (Table 3.1). Fat used was yellow grease

(YG) (15% max FFA) from Hahn and Phillips Grease Company in Marshall, MO. The control diet and post-experimental period diets (Table 3.2) were industry standard diets based on Cobb-Vantress (2015) recommendations, formulated on a digestible amino acids basis and a minimum level of CP. Minimum constraints were placed on YG to force 6 or 8% fat addition. Energy was allowed to increase accordingly. Crude protein (CP) and amino acids (AA) were increased to maintain a consistent CP and AA ratio to energy across all treatments. Fat addition and adjustment for CP and AA were done without regard to cost. All diets were formulated using least-cost formulation software, and included an industry provided premix.

Measurements

Birds were weighed by pen at 0, 10, 14, 17, 35, and 49 days via electronic scale. Feed was weighed and placed in front of pens; a total quantity was recorded at that time and feed disappearance measured at 10 or 14, 17, 35, and 49 days. Mortality weights were recorded daily and used to adjust feed conversion. Feed intake, body weight gain, feed conversion, and adjusted feed conversion were calculated for each period. At 49 days of age, 3 birds per pen (24 birds per treatment), of average weight for their pen, were selected for processing. On day 50 birds were processed to determine carcass and parts yield. Parts collected were pectoralis major and minor, thigh, leg, wing, and fat pad.

Statistical Analysis:

The experiment was a complete randomized block design with the position of each block of pens in the barn being the blocking factor. Data was analyzed by analysis of variance (ANOVA) with a two-way design with the pen being the experimental unit throughout the study. All statements are based on the 0.05 level of significance. Mean separations were done as appropriate using the Tukey's least significant difference test.

RESULTS

Body weight was similar across treatments at 10 DOA, although feed intake (FI) of treatment Cx10 was significantly higher than all other treatments except Cx14 at 10 DOA (Table 3.3). From 0 to 10 days birds fed diet C did not consume significantly more than diets YG6 or YG8 (p-value=0.128, not shown) but feed/gain and adjusted feed/gain were both significantly poorer in birds fed diet C than diets YG6 or YG8 (Table 3.3).

At 14 days, YG8x10 was significantly heavier than all other treatments except Cx10 while Cx14 was significantly lighter than all other treatments except YG6x14 (Table 3.4). From 10 to 14 days, birds fed a pre-starter ration to 10 DOA consumed and gained significantly more than birds fed a pre-starter ration to 14 DOA resulting in significantly poorer feed conversion of birds fed pre-starter to 10 days during the 10 to 14 day period (Table 3.8). Consequently, birds fed pre-starter to 10 days were found to have significantly increased cumulative BW, feed intake, and feed/gain (Table 3.4). Cumulative feed consumption at 14 DOA was significantly higher in birds fed diet C than YG6 but not significantly greater than YG8 (Table 3.4). This resulted in significantly improved feed conversion as fat inclusion increased (Table 3.4). Interactive effects were found in treatments cumulative feed/gain and adjusted feed/gain at 14 DOA (Table 3.4) although only YG8x14 was significantly lower than all other treatments during the 10 to 14 day period (Table 3.8).

From 14 to 17 days, birds fed a pre-starter ration to 14 days gained significantly more weight than birds fed a pre-starter ration to 10 DOA despite similar feed intake causing significantly poorer feed conversion in birds fed pre-starter to 10 DOA (Table 3.9). Cumulative feed intake at 17 DOA was significantly increased in birds fed pre-starter to 10 days due to the difference found at 14 DOA resulting in significantly poorer feed conversion of birds fed pre-starter to 10 days (Table 3.5). Cumulative feed intake and BW at 17 DOA was similar when comparing diet or time fed pre-starter separately although feed conversion was significantly higher in birds fed diet C than YG6 or YG8 (Table 3.5).

There were no cumulative or period effects from time fed pre-starter or diet on BW or feed intake after 17 DOA (Tables 3.6, 3.7, 3.10, 3.11) although cumulative feed consumption of YG8x10 was significantly higher than YG6x14 at both 35 (Table 3.6) and 49 DOA (Table 3.7). At 49 DOA feed conversion of treatment Cx10 was significantly poorer than treatments Cx14, YG6x10, and YG8x14 (Table 3.7). Cumulative feed conversion at 49 DOA was also found to be significantly poorer (2.25 points) in birds fed pre-starter to 10 days than 14 days (Table 3.7).

Although no significance was found between treatments at 49 DOA, treatment C was heaviest followed by YG6 or YG8, each about 40 grams lighter than the previous (Table 3.7). Final BW at 49 DOA was heavier than expected at an average of 3.60 kg, 0.10 kg above the suggested 49 day BW of 3.50 kg (Cobb-Vantress, 2015).

Under normal conditions with no extreme immune challenge, livability was unaffected throughout the trial.

At 50 days of age, three birds of average weight from each pen were slaughtered and parts yield measured. All treatments were similar in percentage of hot carcass, fat pad, major, minor, and total breast, leg, thigh, and wing (Table 3.12). Comparison of diet and time on pre-starter diet were also similar.

DISCUSSION

The primary objective of this study was to determine if high fat pre-starter rations could improve initial performance of chicks and if the observed increase in performance would be maintained to market weight. To do so, birds were fed a pre-starter ration of either a standard low fat diet (C), 6% added fat (YG6), or 8% added fat (YG8) (Table 3.1) for either 10 or 14 days. Yellow grease (YG) was used in this study as it is typically the cheapest source of fat and cost is the recommended selection determinate (Firman et al., 2008).

Consistent with previous research (Fuller and Rendon, 1979; Sell and Owings, 1981; Brue and Latshaw, 1985; Saleh et al., 2004a, b; Dozier et al., 2011; Tancharoenrat and Ravindran, 2014), feed conversion was significantly improved by the addition of fat during the treatment period at 10 and 14 DOA as well as immediately following the treatment period at 17 DOA (Tables 3.3, 3.4, 3.5). This effect was primarily caused by reduced feed intake in birds consuming additional fat as BW was similar across dietary treatments. BW, cumulative feed intake, and cumulative feed conversion were all similar across dietary treatments after 17 DOA (Table 3.6, 3.7).

Lilburn (1998) and Ebling and coworkers (2015) have suggested feeding a higher plain of nutrition during the first 2 weeks of life may better meet the needs of the broiler and improve performance at marketing. This theory is not supported by the present study conducted with broilers in a standard floor pen trial. Fat, starch, and amino acid digestibility are all lowest in the young chick during the first week (Noy and Sklan, 1995;

Batal and Parsons, 2002). Inclusion of a high level of fat, and thus a high plain of nutrition did improve total nutrient retention as feed conversion was improved at 10, 14, and 17 DOA but this effect was not apparent at market (Table 3.7). This improved feed conversion also suggests the use of fats in the diets of young chicks is advisable in agreement with Lilburn (1998).

Although BW was similar between dietary treatments at 10 and 14 DOA (Table 3.5), weight gain was significantly higher and feed conversion was significantly improved in birds consuming YG8 from 10 to 14 days (Table 3.8). In addition, weight gain and feed intake were both significantly higher in birds fed pre-starter to 10 DOA (Table 3.8). In Table 3.8, weight gain is significantly higher in birds fed pre-starter to 10 DOA and YG8x14 over Cx14 and YG6x14. This would appear to confirm the suggestions set by Cobb-Vantress (2015) that a feed change should occur at 10 DOA as the bird appears to require a higher level of energy post 10 DOA. This may not be the case though as treatment YG8x14 feed conversion was significantly better at 14 DOA than all other treatments (Tables 3.4, 3.8) suggesting the bird may still require a high level of energy and protein to 14 DOA. In addition, weight gain and feed conversion were significantly improved from 14 to 17 days in broilers fed pre-starter to 14 DOA compared to pre-starter to 10 DOA (Table 3.9). Consequently, at 17 DOA broilers fed pre-starter to 14 DOA had numerically heavier BW, significantly reduced cumulative feed intake, and significantly improved cumulative feed conversion (Table 3.5). Although no significant cumulative effects were found at 35 DOA, feed conversion was significantly improved in broilers fed pre-starter to 14 DOA compared to broilers fed pre-starter to 10 DOA (Table 3.7).

From the present study, we find the broiler gains more weight immediately following a feed change but improvement in feed conversion does not mirror the improvement in weight gain (Tables 3.8, 3.9). Feeding pre-starter to 14 DOA rather than 10 DOA appears to be beneficial as cumulative feed conversion was significantly improved at 49 DOA (Table 3.7). Feeding a pre-starter ration for a longer period would likely be more beneficial to growth but cost must be considered as a pre-starter ration is essentially a diet with a higher plain of nutrition and thus costs more.

Broilers are commonly fed a starter ration to 17 or 21 days (NRC, 1994). According to the present study, feeding a pre-starter ration with a high plain of nutrition via the addition of high levels of fat to 14 DOA may improve cumulative feed conversion at market thus reducing cost of gain. Maximizing the improvement in feed conversion will require further research to determine at what age a pre-starter, high plain of nutrition ration should be fed to while reduced cost of gain will be highly dependent on ingredient cost and the level of nutrient inclusion in the pre-starter ration.

Today's broiler appears to have an outstanding ability to compensate for lack of BW gain and achieve flock uniformity. This is likely due to the remarkable improvements in broiler genetics (Havenstein et al., 2003b, a) leading to a drive in the broiler to maximally consume feed and grow accordingly. In the current study, Cx14 was the lightest treatment at 17 DOA (Table 3.5) but was the heaviest at both 35 (Table 3.6) and 49 DOA (Table 3.7). At 49 DOA, BW was similar across all treatments with only 130 gram (3.6% of average 49 day BW) difference between the lightest and heaviest treatment (Table 3.7). Studies in how today's broiler adjusts and compensates to deficient or excess energy and protein may lead to a better understanding of how to improve growth through marketing or how to more cheaply feed the birds with early intervention strategies.

CONCLUSION

Additional fat in the pre-starter diet did not result in improved BW or improved feed conversion at market. Feeding the pre-starter ration to 14 DOA rather than 10 DOA did result in improved feed conversion at 49 DOA but further research should be conducted to determine the ideal plain of nutrition and time feeding the pre-starter ration. Under normal conditions, the addition of high level of fats during the pre-starter phase only is not recommended. In the current study, significant improvements in growth and feed conversion were not observed at market and inclusion of high levels of fat raised the pre-starter diet cost.

Table 3.1. Ingredient composition and nutrient profile of experimental diets fed to broilers to either 10 or 14 days of age.

	Treatments		
	C	YG6	YG8
Ingredient	%	%	%
Corn	59.28	50.27	46.41
Soybean Meal	27.01	31.17	32.94
Porkmeal	5.00	5.00	5.00
Corn DDGS	5.00	5.00	5.00
Yellow Grease[1]	1.33	6.00	8.00
Dicalcium Phosphate	0.59	0.72	0.77
Copper Sulfate	0.00	0.00	0.00
Sodium Chloride	0.32	0.32	0.32
Limestone	0.51	0.55	0.60
Choline Chloride	0.02	0.01	0.00
Vitamin/Mineral Premix[2,3]	0.18	0.18	0.18
DL-Methionine	0.33	0.36	0.37
Lysine HCL	0.26	0.23	0.22
Threonine	0.15	0.15	0.15
Avatec	0.05	0.05	0.05
Nutrient			
ME (kcal/kg)	3035	3209	3283
Crude Protein	22.00	23.30	23.85
Calcium	0.90	0.95	0.98
Available Phosphorus	0.45	0.48	0.49
Lysine	1.18	1.25	1.28
Methionine + Cysteine	0.88	0.93	0.95
Threonine	0.77	0.82	0.84
Valine	0.80	0.85	0.87

[1] Yellow Grease Analysis: Total fatty acids, min. 90.0%; Moisture, max. 1.0%; Insoluble impurities, max. 0.5%; Unsaponifiable matter, max. 1.0%; Total M.I.U., max. 2.0%; Free fatty acids, max. 15.0%.
[2] Vitamins provided per kilogram: Vitamin E 93,697 mg; B-12 18000 mcg; Thiamin 2,343 mg; Riboflavin 9,369 mg; Niacin 81,983 mg; Pyridoxine 5,857 mg; Biotin 205 mg; Folate 3,514 mg
[3] Minerals provided per kilogram: Mn 160,000 mg; Zn 150,000 mg; Fe 10,000 mg; Se 240 mg; Mg 20,000 mg

Table 3.2. Ingredient composition and nutrient profile of common diets fed to broilers in all treatments starting at either 11 or 15 days of age through 49 days of age.

	Period		
	11-17	18-35	36-49
Ingredient	%	%	%
Corn	63.79	65.46	67.95
Soybean Meal	22.22	20.06	17.60
Porkmeal	5.00	5.00	5.00
Corn DDGS	5.00	5.00	5.00
Yellow Grease[1]	1.88	2.77	2.74
Dicalcium Phosphate	0.48	0.31	0.32
Copper Sulfate	0.00	0.00	0.00
Sodium Chloride	0.32	0.32	0.32
Limestone	0.44	0.33	0.34
Choline Chloride	0.00	0.00	0.00
Vitamin/Mineral Premix[2,3]	0.18	0.18	0.18
DL-Methionine	0.28	0.24	0.22
Lysine HCL	0.24	0.18	0.20
Threonine	0.13	0.11	0.10
Avatec	0.05	0.05	0.05
Nutrient			
ME (kcal/kg)	3110	3180	3200
Crude Protein	20	19	18
Calcium	0.84	0.76	0.76
Available Phosphorus	0.42	0.38	0.38
Lysine	1.05	0.95	0.90
Methionine + Cysteine	0.80	0.74	0.70
Threonine	0.69	0.65	0.61
Valine	0.73	0.70	0.66

[1] Yellow Grease Analysis: Total fatty acids, min. 90.0%; Moisture, max. 1.0%; Insoluble impurities, max. 0.5%; Unsaponifiable matter, max. 1.0%; Total M.I.U., max. 2.0%; Free fatty acids, max. 15.0%.

[2] Vitamins provided per kilogram: Vitamin E 93,697 mg; B-12 18000 mcg; Thiamin 2,343 mg; Riboflavin 9,369 mg; Niacin 81,983 mg; Pyridoxine 5,857 mg; Biotin 205 mg; Folate 3,514 mg

[3] Minerals provided per kilogram: Mn 160,000 mg; Zn 150,000 mg; Fe 10,000 mg; Se 240 mg; Mg 20,000 mg

Table 3.3. Growth performance from 0 to 10 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.975	0.269	0.258[a]	1.115[a]	1.105[a]
Cx14[1]	0.960	0.264	0.238[ab]	1.114[a]	1.099[a]
YG6x10[1]	0.977	0.269	0.227[b]	1.026[b]	1.029[b]
YG6x14[1]	0.981	0.269	0.230[b]	1.025[b]	1.018[b]
YG8x10[1]	0.970	0.275	0.233[b]	1.011[b]	1.014[b]
YG8x14[1]	0.978	0.270	0.229[b]	1.010[b]	1.011[b]
Diet					
C[2]	0.958	0.259	0.240	1.114[a]	1.120[a]
YG6[2]	0.979	0.266	0.229	1.025[b]	1.020[b]
YG8[2]	0.964	0.266	0.225	1.026[b]	1.009[b]
Time					
10 days[3]	0.974	0.264	0.232	1.055	1.047
14 days[3]	0.960	0.264	0.230	1.055	1.046
Pooled SE	0.028	0.014	0.013	0.024	0.018

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.4. Cumulative growth performance from 0 to 14 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.988	0.467^{ab}	0.529^{a}	1.267^{a}	1.233^{a}
Cx14[1]	0.976	0.424^{d}	0.452^{c}	1.224^{ab}	1.197^{b}
YG6x10[1]	0.970	0.449^{bc}	0.492^{b}	1.214^{b}	1.201^{b}
YG6x14[1]	0.981	0.438^{cd}	0.438^{c}	1.140^{c}	1.138^{c}
YG8x10[1]	0.970	0.474^{a}	0.513^{ab}	1.200^{b}	1.189^{b}
YG8x14[1]	0.974	0.448^{bc}	0.442^{c}	1.103^{c}	1.093^{d}
Diet					
C[2]	0.959	0.441	0.494^{a}	$1.245^{a,4}$	$1.223^{a,4}$
YG6[2]	0.975	0.447	0.472^{b}	$1.151^{b,4}$	$1.170^{b,4}$
YG8[2]	0.972	0.456	0.477^{ab}	$1.177^{b,4}$	$1.141^{c,4}$
Time					
10 days[3]	0.970	0.460^{a}	0.513^{a}	$1.227^{a,4}$	$1.211^{a,4}$
14 days[3]	0.968	0.436^{b}	0.448^{b}	$1.156^{b,4}$	$1.145^{b,4}$
Pooled SE	0.033	0.015	0.021	0.031	0.019

[a-d] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

[4] Interaction within the column was also significant ($p<0.05$).

Table 3.5. Cumulative growth performance from 0 to 17 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.939	0.618[ab]	0.770[a]	1.319[a]	1.278[a]
Cx14[1]	0.934	0.591[b]	0.696[bc]	1.290[a]	1.226[bc]
YG6x10[1]	0.939	0.603[ab]	0.738[abc]	1.293[a]	1.254[ab]
YG6x14[1]	0.947	0.610[ab]	0.689[bc]	1.224[b]	1.193[cd]
YG8x10[1]	0.935	0.625[a]	0.741[ab]	1.288[a]	1.241[ab]
YG8x14[1]	0.944	0.604[ab]	0.682[c]	1.179[b]	1.156[d]
Diet					
C[2]	0.937	0.604	0.725	1.310[a]	1.258[a]
YG6[2]	0.947	0.611	0.720	1.250[b]	1.218[b]
YG8[2]	0.939	0.622	0.712	1.242[b]	1.200[b]
Time					
10 days[3]	0.938	0.606	0.749[a]	1.304[a]	1.258[a]
14 days[3]	0.945	0.618	0.689[b]	1.231[b]	1.192[b]
Pooled SE	0.034	0.021	0.037	0.034	0.026

[a-d] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.6. Cumulative growth performance from 0 to 35 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.952	2.169[ab]	3.253[ab]	1.509	1.493
Cx14[1]	0.939	2.216[a]	3.248[ab]	1.490	1.477
YG6x10[1]	0.924	2.151[ab]	3.218[ab]	1.512	1.486
YG6x14[1]	0.943	2.098[b]	3.143[b]	1.501	1.491
YG8x10[1]	0.926	2.175[ab]	3.271[a]	1.507	1.493
YG8x14[1]	0.935	2.127[ab]	3.248[ab]	1.486	1.476
Diet					
C[2]	0.933	2.193	3.262	1.500	1.490
YG6[2]	0.934	2.158	3.195	1.508	1.486
YG8[2]	0.931	2.179	3.221	1.514	1.491
Time					
10 days[3]	0.930	2.174	3.250	1.517	1.498
14 days[3]	0.935	2.179	3.203	1.497	1.480
Pooled SE	0.027	0.067	0.074	0.024	0.027

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.7. Cumulative growth performance from 0 to 49 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.947	3.532	6.138^{ab}	1.757	1.730^{a}
Cx14[1]	0.933	3.661	6.101^{ab}	1.689	1.671^{b}
YG6x10[1]	0.917	3.574	6.017^{ab}	1.717	1.686^{b}
YG6x14[1]	0.928	3.612	5.938^{b}	1.690	1.691^{ab}
YG8x10[1]	0.913	3.646	6.169^{a}	1.720	1.686^{ab}
YG8x14[1]	0.913	3.610	5.953^{ab}	1.718	1.6832^{b}
Diet					
C[2]	0.935	3.645	6.120	1.722	1.698
YG6[2]	0.922	3.606	5.978	1.704	1.677
YG8[2]	0.913	3.563	6.093	1.736	1.685
Time					
10 days[3]	0.926	3.587	6.086	1.730	1.699^{a}
14 days[3]	0.921	3.623	6.041	1.711	1.674^{b}
Pooled SE	0.038	0.087	0.137	0.043	0.026

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.8. Growth performance from 10 to 14 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight Gain (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.988	0.196[a]	0.278[a]	1.392[a]	1.373[a]
Cx14[1]	0.976	0.161[b]	0.221[b]	1.335[a]	1.332[a]
YG6x10[1]	0.970	0.194[a]	0.267[a]	1.411[a]	1.398[a]
YG6x14[1]	0.981	0.157[b]	0.209[b]	1.333[a]	1.333[a]
YG8x10[1]	0.970	0.198[a]	0.280[a]	1.402[a]	1.400[a]
YG8x14[1]	0.974	0.183[a]	0.216[b]	1.199[b]	1.198[b]
Diet					
C[2]	0.959	0.179[b]	0.247	1.366[a, 4]	1.362[a, 4]
YG6[2]	0.975	0.179[b]	0.239	1.361[a, 4]	1.352[a, 4]
YG8[2]	0.972	0.190[a]	0.246	1.300[b, 4]	1.299[b, 4]
Time					
10 days[3]	0.970	0.196[a]	0.273[a]	1.402[a, 4]	1.394[a, 4]
14 days[3]	0.968	0.169[b]	0.215[b]	1.282[b, 4]	1.281[b, 4]
Pooled SE	0.033	0.01352	0.01118	0.0517	0.0553

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

[4] Interaction within the column was also significant ($p<0.05$).

Table 3.9. Growth performance from 14 to 17 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight Gain (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.939	0.152	0.218	1.560[a]	1.395[a]
Cx14[1]	0.934	0.175	0.219	1.410[c]	1.297[b]
YG6x10[1]	0.939	0.156	0.224	1.516[ab]	1.373[a]
YG6x14[1]	0.947	0.173	0.226	1.429[bc]	1.307[b]
YG8x10[1]	0.935	0.160	0.218	1.569[a]	1.345[ab]
YG8x14[1]	0.944	0.175	0.208	1.425[bc]	1.302[b]
Diet					
C[2]	0.937	0.163	0.219	1.500	1.349
YG6[2]	0.947	0.164	0.223	1.492	1.357
YG8[2]	0.939	0.165	0.217	1.497	1.343
Time					
10 days[3]	0.938	.158[b]	0.219	1.547[a]	1.384[a]
14 days[3]	0.945	.170[a]	0.221	1.446[b]	1.316[b]
Pooled SE	0.034	0.015	0.019	0.057	0.033

[a-c] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.10. Growth performance from 17 to 35 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight Gain (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.952	1.554[ab]	2.473	1.574	1.574
Cx14[1]	0.939	1.625[a]	2.555	1.561	1.561
YG6x10[1]	0.924	1.584[ab]	2.484	1.598	1.582
YG6x14[1]	0.943	1.529[b]	2.460	1.602	1.602
YG8x10[1]	0.926	1.570[ab]	2.499	1.589	1.601
YG8x14[1]	0.935	1.523[b]	2.501	1.609	1.598
Diet					
C[2]	0.933	1.589	2.528	1.567[b]	1.567
YG6[2]	0.934	1.547	2.472	1.594[ab]	1.586
YG8[2]	0.931	1.557	2.500	1.599[a]	1.594
Time					
10 days[3]	0.930	1.556	2.492	1.587	1.582
14 days[3]	0.935	1.572	2.508	1.587	1.583
Pooled SE	0.027	0.059	0.063	0.033	0.032

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.11. Growth performance from 35 to 49 days of broilers fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight Gain (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.947	1.431	2.914	2.107	2.095
Cx14[1]	0.933	1.438	2.848	1.997	1.974
YG6x10[1]	0.917	1.422	2.824	1.969	1.976
YG6x14[1]	0.928	1.473	2.813	1.974	1.975
YG8x10[1]	0.913	1.394	2.835	2.065	2.011
YG8x14[1]	0.913	1.376	2.870	2.022	1.980
Diet					
C[2]	0.935	1.434	2.881	2.052	1.996
YG6[2]	0.922	1.448	2.806	1.970	1.958
YG8[2]	0.913	1.385	2.823	2.104	2.011
Time					
10 days[3]	0.926	1.415	2.849	2.047	2.013
14 days[3]	0.921	1.429	2.825	2.037	1.964
Pooled SE	0.038	0.119	0.099	0.082	0.097

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of eight replicate pens initially containing 33 broilers per pen.

[2] Data are means of 16 replicate pens initially containing 33 broilers per pen.

[3] Data are means of 24 replicate pens initially containing 33 broilers per pen.

Table 3.12. Processing yields of broilers at 50 days of age, after 12 hours fasting, fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Hot Carcass[4]	Fat Pad[5]	Major Breast[5]	Minor Breast[5]	Total Breast[5]	Leg[5]	Thigh[5]	Wing[5]
Cx10[1]	71.39	2.33	26.11	5.36	31.08	15.29	18.64	11.57
Cx14[1]	72.68	2.59	26.56	5.52	31.67	15.10	19.16	11.45
YG6x10[1]	72.04	2.55	26.46	5.54	32.00	15.30	19.30	11.78
YG6x14[1]	72.40	2.50	26.09	5.51	31.68	15.22	18.81	11.23
YG8x10[1]	71.70	2.91	25.92	5.29	31.22	15.20	18.97	11.60
YG8x14[1]	72.68	2.44	26.50	5.36	31.83	15.05	18.65	11.58
Diet								
C[2]	72.41	2.46	26.09	5.31	31.37	15.30	18.99	11.56
YG6[2]	72.43	2.59	26.27	5.57	31.84	15.33	18.99	11.50
YG8[2]	72.24	2.72	26.39	5.33	31.72	15.13	18.81	11.58
Time								
10 days[3]	72.17	2.64	26.08	5.37	31.43	15.30	18.93	11.68
14 days[3]	72.56	2.54	26.42	5.44	31.86	15.21	18.93	11.41
Pooled SE	1.96	0.83	2.40	0.68	2.91	1.19	1.38	0.88

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 24 carcasses per treatment.

[2] Data are means of 48 carcasses per treatment.

[3] Data are means of 72 carcasses per treatment.

[4] Expressed as a percent of live weight.

[5] Expressed as a percent of the hot carcass weight.

EFFECTS OF HIGH FAT TURKEY PRE-STARTER RATIONS ON PERFORMANCE

Abstract

An experiment was conducted to test the addition of 6% or 8% yellow grease (YG) to diets of turkeys during the 0-10 day or 0-14 day pre-starter period. Forty-eight pens of birds were fed one of 6 treatments to consist of a control (least cost addition of YG), 6% YG, or 8% YG, each fed to either 10 or 14 days. Eight replicate pens were used for each treatment arranged in a randomized complete block design with location as the blocking factor. Each pen contained 12 commercial strain tom poults placed at hatch and raised to 20 weeks of age. Diets consisted of commercial type corn-soy-DDGS-meat meal base and were adjusted to maintain a consistent relationship between energy and crude protein as well as amino acids. Birds were weighed and diets changed at 10 or 14 days, and at 3 week intervals to 20 weeks of age. No differences in performance were observed by addition of high levels of fat during the pre-starter period.These results suggest the addition of high levels of fat in the pre-starter ration does not improve performance in turkeys.

Keywords: turkeys, fat addition, pre-starter

Introduction

Relatively little recent research has been published on use of different fat levels in poultry. No publications described the proposed research per se. High fat diets have a positive impact on body weight (BW) gain and feed efficiency (FE) as compared to diets with normal amounts of fat when fed throughout the life of the bird in both chickens (Sahito et al., 2012) and turkeys (Sell and Owings, 1981). This phenomenon is true in nearly every variation of environment tested. Chicks 5-7 weeks of age in a floor pen trial, a proper stimulation of industry settings, preferred and achieved improved BW gain with high fat diets over high CHO and low fat diets in both temperate and heat stress environments (Dale and Fuller, 1978). When temperatures were hot, cool, and cycled to simulate day and night during the summer, the 4+ week old chicks fed high fat diets had a significant improvement of BW gain over those fed low fat diets. This benefit may be due to the lower heat increment of dietary fat (Dale and Fuller, 1980). In addition to all environmental conditions, improved BW gain and FE were observed in all high fat diets regardless of source in a finishing diet (Fuller and Rendon, 1979; Ouart et al., 1992). The one exception might be high free fatty acid (FFA) yellow grease (YG) which was found to have negative effects on BW gain after 21 days of age when the inclusion rate was 3%. Interestingly, FFA levels had no effect on BW gain or FE during the starter phase when inclusion rate was only 1.5% (Wu et al., 2011). Dale and Fuller (1978) again observed a preference for high fat diets over low fat diets regardless of temperature, but also found the same preference true in both mash and pellet form. No preference was found between mash and pellets of the same high fat diet. From this Dale and Fuller (1979) inferred that reduced heat increment and texture of high fat diets may not be the reason for the birds preference because they preferred high fat to low fat, which have the same texture and color, and they preferred high fat in the cold environment where a higher heat increment would be beneficial. The benefit that influences the birds decision to consume high fat diets may be the extra-caloric effect by which fat positively affects the energy availability of other ingredients (Jensen et al., 1970). This was confirmed in a study finding the addition of fat improved the digestibility of meat and bone meal (Firman and Remus, 1994). Higher fat diets increase the metabolizable energy (ME) available due to the increase in ME from the fat and because of the extra caloric effect. A concern became that feed intake may decrease. Only minor adjustments in feed intake were found between 2.5 and 10% fat inclusion with the high levels of fat resulting in more BW gain and improved FE. With only minor feed intake adjustments made, the birds total ME consumption increased and it was found that the birds ate more feed/day, but average daily gain (ADG) and FE were improved because of a shorter time to slaughter weight. Most high fat studies have been done with birds 3+ weeks of age. The little research conducted over the life of the bird has shown positive effects at a young age as noted above. It has been found that fat absorbability is poor in the very young chick, but appears to develop rapidly after the first few days and is maximally absorbing fat by two weeks of age if not sooner (Carew et al., 1972). As noted by Lilburn (1998), the low absorbability of fats in the young chick doesn't mean that fat shouldn't be used in young chick diets. The hatchling is geared to oxidize fatty acids so providing it with a large amount of energy in the form of fat would be beneficial as compared to the normal method of providing energy with high-protein, low available carbohydrates that rely on gluconeogenesis to be used. The use of high fat during the starter phase is still a practical implication (Lilburn, 1998). Research has also found that the effects of feeding a high concentration of protein, energy, vitamins, and minerals during the first 2 weeks resulted in a larger BW bird at the end of 2 weeks and that this increased BW was still apparent at the end of 14 weeks when the trial ended (Moran, 1978). The proposed study would seek to determine if fat alone for a short period during the beginning of the life cycle would be beneficial to the turkey throughout the growth period.

Experimental Procedures

Forty-eight pens of broilers turkeys (12 toms/pen) were used in a 2 x 3 factorial design with 6 treatments and 8 replicate pens. Treatments included a low fat starter diet, 6% and 8% added fat (standard yellow grease-15% max FFA, std FA profile) x two time periods (10 days and 14 days) on diet. Fat was split and added both in the mix and post-pelleting when levels are high. Fat at less than 4% of the diet was added in the mixer before pelleting. Energy levels were allowed to increase with the fat additions and other ingredients/nutrients were adjusted as needed to accommodate the additional fat and maintain ME/ideal protein ratio (0.46%dlysine/mcal). These diets will be fed for either the 10 or 14 day period noted above followed by industry standard diets through the rest of the growout period. Poults were obtained from a commercial source on day of hatch. Birds were weighed and (small birds removed from the group) placed into floor pens in curtain sided buildings. Standard husbandry practices were followed based on our SOP's (copies available on request) and birds were weighed at each feed change. Turkeys and feed were weighed at 10 or 14 days followed by diet changes at 21, 42, 63, 84, 105, 126 and 140 days. On day 141, 2 toms per pen were slaughtered in our pilot processing plant for carcass yield determination. Mortality was monitored on a daily basis. All data were analyzed by the GLM procedure for a 2 x 3 factorial ANOVA using Minitab software with a significance level set at 0.05

Results and discussion

Results of the turkey trial are noted in the tables below. In turkeys, few differences were seen in any of the parameters measured. Birds performed well reaching ~44 pounds at 20 weeks of age. No consistent differences were seen in body weight gain, feed/gain or feed intake at any of the time periods. At the conclusion of the trial no differences in any parameters were noted. A slight increase in fat pad size was noted in the processing yield at the higher fat inclusion level. No other yield differences were noted.

The primary objective of this study was to determine if high fat pre-starter rations could improve initial performance of turkey poults and if the observed increase in performance would be maintained to market weight. Yellow grease (YG) was used in this study as it is typically the cheapest source of fat and cost is the recommended selection determinate (Firman et al., 2008).

Unlike previous research (Fuller and Rendon, 1979; Sell and Owings, 1981; Brue and Latshaw, 1985; Saleh et al., 2004a, b; Dozier et al., 2011; Tancharoenrat and Ravindran, 2014), feed conversion was not improved by the addition of fat during the treatment period through fat addition. Lilburn (1998) and Ebling and coworkers (2015) have suggested feeding a higher plain of nutrition during the first 2 weeks of life may better meet the needs of the broilers and improve performance at marketing. This theory is not supported by the present study conducted with turkeys in a standard floor pen trial. Fat, starch, and amino acid digestibility are all lowest in the young chick during the first week (Noy and Sklan, 1995; Batal and Parsons, 2002). It would appear that early inclusion of fat at high levels does not result in performance benefits.

Table 1.1. Growth performance from 0 to 10 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.969	0.217	0.207	1.350	1.334
Cx14[1]	0.958	0.218	0.203	1.348	1.329
YG6x10[1]	0.916	0.209	0.199	1.459	1.417
YG6x14[1]	0.927	0.209	0.200	1.509	1.458
YG8x10[1]	0.989	0.219	0.203	1.269	1.261
YG8x14[1]	0.958	0.214	0.203	1.397	1.298
Diet					
C[2]	0.964[a]	0.217	0.207	1.349	1.332
YG6[2]	0.921[ab]	0.209	0.203	1.484	1.437
YG8[2]	0.974[b]	0.216	0.199	1.333	1.279
P-Value	0.04				
Time					
10 days[3]	0.958	0.215	0.207	1.359	1.337
14 days[3]	0.948	0.214	0.203	1.418	1.362
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.2. Growth performance from 0 to 14 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.969	0.355	0.382	1.286	1.278
Cx14[1]	0.948	0.355	0.374	1.272	1.254
YG6x10[1]	0.917	0.349	0.384	1.311	1.249
YG6x14[1]	0.927	0.340	0.361	1.332	1.289
YG8x10[1]	0.989	0.361	0.384	1.267	1.263
YG8x14[1]	0.958	0.348	0.361	1.251	1.237
Diet					
C[2]	0.959	0.355	0.378	1.279	1.266
YG6[2]	0.922	0.345	0.372	1.322	1.269
YG8[2]	0.974	0.354	0.373	1.259	1.250
Time					
10 days[3]	0.958	0.355	0.383a	1.288	1.263
14 days[3]	0.945	0.348	0.365b	1.285	1.260
P-Value			0.01		
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.3. Growth performance from 0 to 21 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.958	0.747	0.847	1.297	1.287
Cx14[1]	0.948	0.740	0.850	1.269	1.262
YG6x10[1]	0.917	0.720	0.839	1.277	1.268
YG6x14[1]	0.885	0.714	0.829	1.371	1.331
YG8x10[1]	0.979	0.748	0.869	1.275	1.274
YG8x14[1]	0.958	0.715	0.848	1.295	1.288
Diet					
C[2]	0.953[ab]	0.744	0.848	1.283	1.275
YG6[2]	0.901[b]	0.717	0.834	1.324	1.299
YG8[2]	0.969[a]	0.731	0.859	1.285	1.281
P-Value	0.023				
Time					
10 days[3]	0.951	0.738	0.852	1.283	1.276
14 days[3]	0.931	0.723	0.843	1.312	1.294
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.4. Growth performance from 0 to 42 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.948	2.97	4.07	1.360	1.344
Cx14[1]	0.927	2.96	4.19	1.488	1.479
YG6x10[1]	0.881	2.93	4.26	1.558	1.542
YG6x14[1]	0.864	2.90	4.42	1.563	1.554
YG8x10[1]	0.928	2.99	4.20	1.505	1.504
YG8x14[1]	0.948	2.87	4.29	1.501	1.496
Diet					
C[2]	0.938[a]	2.96	4.13	1.424	1.412
YG6[2]	0.873[b]	2.92	4.34	1.560	1.548
YG8[2]	0.938[a]	2.93	4.25	1.503	1.501
P-Value	0.024				
Time					
10 days[3]	0.958	2.96	4.18	1.475	1.463
14 days[3]	0.948	2.91	4.30	1.517	1.509
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.5. Growth performance from 0 to 63 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.948	6.01	10.31	1.733	1.722
Cx14[1]	0.917	6.01	10.35	1.758	1.754
YG6x10[1]	0.869	6.20	10.61	1.756	1.747
YG6x14[1]	0.855	5.99	10.30	1.775	1.752
YG8x10[1]	0.917	5.71	10.47	1.862	1.862
YG8x14[1]	0.948	5.88	10.38	1.801	1.785
Diet					
C[2]	0.933[a]	6.01	10.33	1.746	1.738
YG6[2]	0.862[b]	6.09	10.45	1.766	1.749
YG8[2]	0.933[a]	5.79	10.42	1.831	1.823
P-Value	0.01				
Time					
10 days[3]	0.912	5.97	10.46	1.784	1.777
14 days[3]	0.906	5.96	10.34	1.778	1.764
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.6. Growth performance from 0 to 84 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.938	9.58	18.86	2.010	1.985
Cx14[1]	0.865	9.77	19.32	2.129	2.032
YG6x10[1]	0.798	9.93	19.89	2.216	2.074
YG6x14[1]	0.782	9.39	20.13	2.175	2.052
YG8x10[1]	0.875	9.77	19.44	2.131	2.048
YG8x14[1]	0.917	9.75	19.61	2.147	2.060
Diet					
C[2]	0.901[a]	9.67	19.09	2.069	2.009
YG6[2]	0.789[b]	9.93	20.01	2.195	2.063
YG8[2]	0.896[a]	9.76	19.52	2.139	2.054
P-Value	0.002				
Time					
10 days[3]	0.870	9.76	19.40	2.119	2.035
14 days[3]	0.854	9.82	19.69	2.150	2.048
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.7. Growth performance from 0 to 105 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.855	13.86	31.46	2.570	2.343
Cx14[1]	0.823	14.25	31.38	2.329	2.194
YG6x10[1]	0.738	14.27	32.72	2.400	2.255
YG6x14[1]	0.771	14.47	32.46	2.313	2.124
YG8x10[1]	0.833	14.29	31.93	2.387	2.246
YG8x14[1]	0.844	13.90	32.24	2.535	2.266
Diet					
C[2]	0.839[a]	14.05	31.42	2.449	2.269
YG6[2]	0.755[b]	14.37	32.59	2.357	2.189
YG8[2]	0.839[a]	14.09	32.08	2.461	2.256
P-Value	0.015				
Time					
10 days[3]	0.809	14.14	32.04	2.452	2.281[a]
14 days[3]	0.813	14.21	32.02	2.393	2.195[b]
P-Value					0.047
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.8. Growth performance from 0 to 126 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.792	17.69	44.26	2.785	2.364
Cx14[1]	0.729	17.86	44.32	2.750	2.359
YG6x10[1]	0.691	18.03	44.96	2.686	2.312
YG6x14[1]	0.760	18.21	44.79	2.507	2.317
YG8x10[1]	0.802	18.08	43.91	2.515	2.319
YG8x14[1]	0.771	17.62	44.72	2.687	2.426
Diet					
C[2]	0.760	17.78	43.79	2.767	2.361
YG6[2]	0.726	18.12	44.87	2.596	2.314
YG8[2]	0.787	17.85	44.32	2.601	2.373
Time					
10 days[3]	0.762	17.93	44.38	2.662	2.332
14 days[3]	0.754	17.90	44.28	2.648	2.367
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 1.9. Growth performance from 0 to 140 days of tom turkeys fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Livability (%)	Body Weight (kg)	Feed Intake (kg)	Feed/Gain	Adjusted Feed/Gain
Cx10[1]	0.739	19.59	52.83	2.995	2.406
Cx14[1]	0.677	19.90	51.04	2.793	2.256
YG6x10[1]	0.643	20.45	53.07	2.864	2.299
YG6x14[1]	0.708	20.11	52.95	2.756	2.495
YG8x10[1]	0.750	20.06	51.40	2.797	2.450
YG8x14[1]	0.719	19.90	52.93	2.902	2.424
Diet					
C[2]	0.708	19.75	51.94	2.894	2.331
YG6[2]	0.676	20.28	53.01	2.810	2.397
YG8[2]	0.734	19.98	52.17	2.849	2.437
Time					
10 days[3]	0.711	20.03	52.43	2.885	2.385
14 days[3]	0.701	19.97	52.31	2.817	2.392
Pooled SE					

[a-b] Means within a column with no common superscripts differ significantly by Tukey method ($p<0.05$).

[1] Data are means of 8 replicate pens initially containing 12 tom turkeys per pen.

[2] Data are means of 16 replicate pens initially containing 12 tom turkeys per pen.

[3] Data are means of 24 replicate pens initially containing 12 tom turkeys per pen.

Table 3.12. Processing yields of tom turkeys 141 days of age, after 12 hours fasting, fed control (C), 6% addition of YG (YG6), or 8% addition of YG (YG8) for either 10 days (x10) or 14 days (x14).

Treatment	Hot Carcass[4]	Fat Pad[5]	Major Breast[5]	Minor Breast[5]	Total Breast[5]	Leg[5]	Thigh[5]	Wing[5]
Cx10[1]	79.32	0.781	29.78	6.21	35.99	13.32	14.74	11.06
Cx14[1]	79.54	0.946	30.09	6.40	36.50	13.23	14.43	11.20
YG6x10[1]	80.10	0.753	30.17	6.31	36.49	13.36	15.08	11.21
YG6x14[1]	81.66	0.966	29.13	6.10	35.23	13.06	14.51	10.90
YG8x10[1]	79.52	1.058	30.08	6.22	36.30	12.79	14.69	11.10
YG8x14[1]	79.25	1.112	29.33	6.26	35.59	13.09	14.73	11.26
Diet								
C[2]	79.43	0.864[b]	29.93	6.31	36.24	13.27	14.59	11.13
YG6[2]	80.89	0.859[b]	29.65	6.21	35.86	13.21	14.79	11.05
YG8[2]	79.38	1.084[a]	29.70	6.24	35.94	12.94	14.71	11.18
P-Value		0.01						
Time								
10 days[3]	79.65	0.861[b]	30.01	6.25	36.26	13.15	14.84	11.12
14 days[3]	80.14	1.011[a]	29.52	6.25	35.77	13.12	14.56	11.12
P-Value		0.028						
Pooled SE								

[a-b] Means within a column with no common superscripts differ significantly by Tukey method (p<0.05).

[1] Data are means of 16 carcasses per treatment.

[2] Data are means of 32 carcasses per treatment.

[3] Data are means of 48 carcasses per treatment.

[4] Expressed as a percent of live weight.

[5] Expressed as a percent of the hot carcass weight.

Conclusions

No differences in performance were noted in the study. While it would appear that increased fat levels should improve performance and feed efficiency, such was not the case in this study.

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0-3 wks 6% Fat

Diet Name: **0.06**

Feed Cost: $ 296.1088

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**38.035**	100.00	760.71
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**39.230**	100.00	784.60
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**5.000**	5.00	100.00
Yellow Grease	28.75	6.00	**6.000**	6.00	120.00
Butterball Trace Mineral	40.00	0.09	**0.090**	0.09	1.80
Rovimix	50.00	0.13	**0.125**	0.13	2.50
Dicalcium Phosphate	34.40	0.00	**1.604**	100.00	32.07
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.856**	100.00	17.13
Choline Cl	62.50	0.00	**0.026**	100.00	0.51
DL-Methionine	211.70	0.00	**0.275**	100.00	5.50
Lysine HCL	132.00	0.00	**0.258**	100.00	5.15
Threonine	211.70	0.00	**0.082**	100.00	1.65
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.062**	100.00	1.24
Copper Sulfate	30.00	0.01	**0.007**	100.00	0.14
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**87.242**	100.00
Metabolozable Energy	Kcal/kg	2950.00	**3067.721**	10000.00
Protein	%	0.00	**27.669**	100.00
Ether Extract	%	0.00	**8.968**	100.00
Linoleic Acid	%	1.25	**1.250**	100.00
Crude Fiber	%	0.00	**2.822**	100.00
Calcium	%	1.55	**1.553**	100.00
Total Phosphorus	%	0.00	**1.130**	100.00
Avail. Phosphorus	%	0.79	**0.793**	100.00
Potassium	%	0.00	**1.041**	100.00
Chlorine	%	0.00	**0.279**	100.00
Manganese	mg/kg	0.00	**170.662**	5000.00
Sodium	%	0.00	**0.214**	100.00
Zinc	mg/kg	0.00	**178.070**	10000.00
Iron	mg/kg	0.00	**307.610**	5000.00
Copper	mg/kg	20.00	**38.136**	5000.00
Selenium	mg/kg	0.00	**0.306**	5000.00
Magnesium	mg/kg	0.00	**18.290**	5000.00
Sulfur	%	0.00	**0.278**	100.00
Vitamin E	mg/kg	0.00	**128.745**	5000.00
Thiamin	mg/kg	0.00	**5.849**	5000.00
Riboflavin	mg/kg	0.00	**14.011**	5000.00
Niacin	mg/kg	0.00	**127.468**	5000.00
Pyridoxine	mg/kg	0.00	**13.079**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.626**	5000.00
Biotin	mg/kg	0.00	**30.416**	5000.00
Choline	mg/kg	1600.00	**1600.000**	5000.00
Folate	mg/kg	0.00	**5.079**	5000.00
ARG	%	0.00	**1.739**	100.00
GLY	%	0.00	**1.262**	100.00
SER	%	0.00	**1.177**	100.00
GLY&SER	%	0.00	**2.439**	100.00
HIS	%	0.00	**0.646**	100.00
ILE	%	0.00	**0.957**	100.00
LEU	%	0.00	**1.956**	100.00
LYS	%	1.54	**1.540**	100.00
MET	%	0.00	**0.621**	100.00
CYS	%	0.00	**0.305**	100.00
TSAA	%	0.93	**0.926**	100.00
PHE	%	0.00	**1.095**	100.00
TYR	%	0.00	**0.831**	100.00
TAAA	%	0.00	**1.921**	100.00
THR	%	0.89	**0.885**	100.00
TRP	%	0.00	**0.292**	100.00
VAL	%	1.07	**1.070**	100.00

0-3 weeks 8% Fat

Diet Name: 0.08

Feed Cost: $ 314.0829

Ingredient	Cost	Min.	Amount	0.00	Lbs.
	$/cwt	%	%	%	per ton
Corn (Digestible2011)	6.59	0.00	**38.640**	100.00	772.80
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**35.905**	100.00	718.10
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**5.000**	5.00	100.00
Yellow Grease	28.75	8.00	**8.000**	8.00	160.00
Butterball Trace Mineral	40.00	0.09	**0.090**	0.09	1.80
Rovimix Vitamin Premix	50.00	0.13	**0.125**	0.13	2.50
Dicalcium Phosphate	34.40	0.00	**1.784**	100.00	35.68
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.939**	100.00	18.79
Choline Cl	62.50	0.00	**0.042**	100.00	0.85
DL-Methionine	211.70	0.00	**0.346**	100.00	6.92
Lysine HCL	132.00	0.00	**0.444**	100.00	8.88
Threonine	211.70	0.00	**0.166**	100.00	3.31
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	250.00	0.00	**0.162**	100.00	3.24
Copper Sulfate	30.00	0.01	**0.007**	100.00	0.14
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**86.923**	100.00
Metabolozable Energy	Kcal/kg	2950.00	**3184.022**	10000.00
Protein	%	0.00	**26.530**	100.00
Ether Extract	%	0.00	**10.917**	100.00
Linoleic Acid	%	1.25	**1.250**	100.00
Crude Fiber	%	0.00	**2.705**	100.00
Calcium	%	1.61	**1.610**	100.00
Total Phosphorus	%	0.00	**1.149**	100.00
Avail. Phosphorus	%	0.82	**0.824**	100.00
Potassium	%	0.00	**0.978**	100.00
Chlorine	%	0.00	**0.277**	100.00
Manganese	mg/kg	0.00	**169.815**	5000.00
Sodium	%	0.00	**0.213**	100.00
Zinc	mg/kg	0.00	**176.711**	10000.00
Iron	mg/kg	0.00	**320.108**	5000.00
Copper	mg/kg	20.00	**37.683**	5000.00
Selenium	mg/kg	0.00	**0.303**	5000.00
Magnesium	mg/kg	0.00	**18.284**	5000.00
Sulfur	%	0.00	**0.266**	100.00
Vitamin E	mg/kg	0.00	**128.778**	5000.00
Thiamin	mg/kg	0.00	**5.764**	5000.00
Riboflavin	mg/kg	0.00	**13.921**	5000.00
Niacin	mg/kg	0.00	**126.881**	5000.00
Pyridoxine	mg/kg	0.00	**12.955**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.626**	5000.00
Biotin	mg/kg	0.00	**30.406**	5000.00
Choline	mg/kg	1600.00	**1600.000**	5000.00
Folate	mg/kg	0.00	**5.038**	5000.00
ARG	%	0.00	**1.632**	100.00
GLY	%	0.00	**1.206**	100.00
SER	%	0.00	**1.107**	100.00
GLY&SER	%	0.00	**2.314**	100.00
HIS	%	0.00	**0.608**	100.00
ILE	%	0.00	**0.898**	100.00
LEU	%	0.00	**1.856**	100.00
LYS	%	1.60	**1.600**	100.00
MET	%	0.00	**0.673**	100.00
CYS	%	0.00	**0.289**	100.00
TSAA	%	0.96	**0.962**	100.00
PHE	%	0.00	**1.031**	100.00
TYR	%	0.00	**0.780**	100.00
TAAA	%	0.00	**1.807**	100.00
THR	%	0.92	**0.920**	100.00
TRP	%	0.00	**0.273**	100.00
VAL	%	1.11	**1.110**	100.00

0-3 weeks control

Diet Name: HF Control 0-3

Feed Cost: $ 276.3114

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**40.241**	100.00	804.81
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**40.087**	100.00	801.74
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**5.000**	5.00	100.00
Yellow Grease	28.75	1.00	**3.478**	4.00	69.57
Butterball Trace Mineral	40.00	0.09	**0.090**	0.09	1.80
Rovimix Vitamin Premix	50.00	0.13	**0.125**	0.13	2.50
Dicalcium Phosphate	34.40	0.00	**1.429**	100.00	28.58
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.770**	100.00	15.41
Choline Cl	62.50	0.00	**0.018**	100.00	0.37
DL-Methionine	211.70	0.00	**0.222**	100.00	4.45
Lysine HCL	132.00	0.00	**0.152**	100.00	3.05
Threonine	211.70	0.00	**0.029**	100.00	0.58
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
Copper Sulfate	30.00	0.01	**0.007**	100.00	0.14
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**87.502**	100.00
Metabolozable Energy	Kcal/kg	2950.00	**2950.000**	10000.00
Protein	%	28.00	**28.000**	100.00
Ether Extract	%	0.00	**6.589**	100.00
Linoleic Acid	%	1.25	**1.302**	100.00
Crude Fiber	%	0.00	**2.904**	100.00
Calcium	%	1.49	**1.490**	100.00
Total Phosphorus	%	0.00	**1.105**	100.00
Avail. Phosphorus	%	0.76	**0.760**	100.00
Potassium	%	0.00	**1.065**	100.00
Chlorine	%	0.00	**0.280**	100.00
Manganese	mg/kg	0.00	**170.662**	5000.00
Sodium	%	0.00	**0.214**	100.00
Zinc	mg/kg	0.00	**178.589**	10000.00
Iron	mg/kg	0.00	**292.637**	5000.00
Copper	mg/kg	20.00	**38.305**	5000.00
Selenium	mg/kg	0.00	**0.308**	5000.00
Magnesium	mg/kg	0.00	**18.292**	5000.00
Sulfur	%	0.00	**0.281**	100.00
Vitamin E	mg/kg	0.00	**129.256**	5000.00
Thiamin	mg/kg	0.00	**5.954**	5000.00
Riboflavin	mg/kg	0.00	**14.058**	5000.00
Niacin	mg/kg	0.00	**128.186**	5000.00
Pyridoxine	mg/kg	0.00	**13.276**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.626**	5000.00
Biotin	mg/kg	0.00	**30.420**	5000.00
Choline	mg/kg	1600.00	**1600.000**	5000.00
Folate	mg/kg	0.00	**5.099**	5000.00
ARG	%	0.00	**1.775**	100.00
GLY	%	0.00	**1.282**	100.00
SER	%	0.00	**1.203**	100.00
GLY&SER	%	0.00	**2.485**	100.00
HIS	%	0.00	**0.660**	100.00
ILE	%	0.00	**0.979**	100.00
LEU	%	0.00	**2.004**	100.00
LYS	%	1.48	**1.484**	100.00
MET	%	0.00	**0.577**	100.00
CYS	%	0.00	**0.313**	100.00
TSAA	%	0.89	**0.890**	100.00
PHE	%	0.00	**1.120**	100.00
TYR	%	0.00	**0.850**	100.00
TAAA	%	0.00	**1.965**	100.00
THR	%	0.85	**0.850**	100.00
TRP	%	0.00	**0.299**	100.00
VAL	%	0.00	**1.032**	100.00

3-6 weeks

Diet Name: HF Control 3-6

Feed Cost: $ 261.1487

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**46.970**	100.00	939.39
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**34.713**	100.00	694.27
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**5.000**	5.00	100.00
Oil (other)	28.75	1.00	**3.218**	8.00	64.35
CA Tmineral Mix	40.00	0.13	**0.125**	0.25	2.50
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.698**	100.00	13.96
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.355**	100.00	7.10
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.197**	100.00	3.93
Lysine HCL	132.00	0.00	**0.184**	100.00	3.68
Threonine	211.70	0.00	**0.033**	100.00	0.65
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.033**	100.00	0.66
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**88.414**	100.00
Metabolozable Energy	Kcal/kg	3025.00	**3025.000**	10000.00
Protein	%	26.00	**26.000**	100.00
Ether Extract	%	0.00	**6.535**	100.00
Linoleic Acid	%	1.20	**1.428**	100.00
Crude Fiber	%	0.00	**2.842**	100.00
Calcium	%	1.20	**1.200**	100.00
Total Phosphorus	%	0.00	**0.937**	100.00
Avail. Phosphorus	%	0.60	**0.600**	100.00
Potassium	%	0.00	**0.978**	100.00
Chlorine	%	0.00	**0.280**	100.00
Manganese	mg/kg	0.00	**1332.628**	5000.00
Sodium	%	0.00	**0.214**	100.00
Zinc	mg/kg	0.00	**1350.383**	10000.00
Iron	mg/kg	0.00	**933.407**	5000.00
Copper	mg/kg	0.00	**25.356**	5000.00
Selenium	mg/kg	0.00	**0.163**	5000.00
Magnesium	mg/kg	0.00	**0.271**	5000.00
Sulfur	%	0.00	**0.254**	100.00
Vitamin E	mg/kg	0.00	**21.705**	5000.00
Thiamin	mg/kg	0.00	**3.514**	5000.00
Riboflavin	mg/kg	0.00	**5.558**	5000.00
Niacin	mg/kg	0.00	**39.890**	5000.00
Pyridoxine	mg/kg	0.00	**6.158**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.609**	5000.00
Biotin	mg/kg	0.00	**30.167**	5000.00
Choline	mg/kg	0.00	**1591.432**	5000.00
Folate	mg/kg	0.00	**1.007**	5000.00
ARG	%	0.00	**1.621**	100.00
GLY	%	0.00	**1.205**	100.00
SER	%	0.00	**1.110**	100.00
GLY&SER	%	0.00	**2.316**	100.00
HIS	%	0.00	**0.610**	100.00
ILE	%	0.00	**0.897**	100.00
LEU	%	0.00	**1.896**	100.00
LYS	%	1.38	**1.380**	100.00
MET	%	0.00	**0.532**	100.00
CYS	%	0.00	**0.296**	100.00
TSAA	%	0.83	**0.828**	100.00
PHE	%	0.00	**1.037**	100.00
TYR	%	0.00	**0.783**	100.00
TAAA	%	0.00	**1.815**	100.00
THR	%	0.79	**0.790**	100.00
TRP	%	0.00	**0.271**	100.00
VAL	%	0.99	**0.990**	100.00

6-9 weeks

Diet Name: HF Control 6-9

Feed Cost: $ 240.4661

Ingredient	Cost	Min.	Amount	Max.	Lbs.
	$/cwt	%	%	%	per ton
Corn (Digestible2011)	6.59	0.00	**50.793**	100.00	1015.85
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**28.481**	100.00	569.61
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**8.000**	8.00	160.00
Yellow Grease	28.75	1.00	**3.533**	8.00	70.66
CA Tmineral Mix	40.00	0.13	**0.125**	0.25	2.50
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.217**	100.00	4.33
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.098**	100.00	1.96
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.121**	100.00	2.43
Lysine HCL	132.00	0.00	**0.143**	100.00	2.85
Threonine	211.70	0.00	**0.015**	100.00	0.30
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**89.157**	100.00
Metabolozable Energy	Kcal/kg	3100.00	**3100.000**	10000.00
Protein	%	24.00	**24.000**	100.00
Ether Extract	%	0.00	**7.197**	100.00
Linoleic Acid	%	1.10	**1.624**	100.00
Crude Fiber	%	0.00	**2.956**	100.00
Calcium	%	1.00	**1.000**	100.00
Total Phosphorus	%	0.00	**0.830**	100.00
Avail. Phosphorus	%	0.50	**0.500**	100.00
Potassium	%	0.00	**0.885**	100.00
Chlorine	%	0.00	**0.283**	100.00
Manganese	mg/kg	0.00	**1329.492**	5000.00
Sodium	%	0.00	**0.227**	100.00
Zinc	mg/kg	0.00	**1349.080**	10000.00
Iron	mg/kg	0.00	**884.489**	5000.00
Copper	mg/kg	0.00	**26.173**	5000.00
Selenium	mg/kg	0.00	**0.170**	5000.00
Magnesium	mg/kg	0.00	**0.255**	5000.00
Sulfur	%	0.00	**0.233**	100.00
Vitamin E	mg/kg	0.00	**23.559**	5000.00
Thiamin	mg/kg	0.00	**3.535**	5000.00
Riboflavin	mg/kg	0.00	**5.674**	5000.00
Niacin	mg/kg	0.00	**41.566**	5000.00
Pyridoxine	mg/kg	0.00	**6.180**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.610**	5000.00
Biotin	mg/kg	0.00	**48.149**	5000.00
Choline	mg/kg	0.00	**1444.932**	5000.00
Folate	mg/kg	0.00	**0.941**	5000.00
ARG	%	0.00	**1.460**	100.00
GLY	%	0.00	**1.131**	100.00
SER	%	0.00	**1.018**	100.00
GLY&SER	%	0.00	**2.150**	100.00
HIS	%	0.00	**0.562**	100.00
ILE	%	0.00	**0.814**	100.00
LEU	%	0.00	**1.802**	100.00
LYS	%	1.21	**1.210**	100.00
MET	%	0.00	**0.444**	100.00
CYS	%	0.00	**0.282**	100.00
TSAA	%	0.73	**0.726**	100.00
PHE	%	0.00	**0.959**	100.00
TYR	%	0.00	**0.717**	100.00
TAAA	%	0.00	**1.671**	100.00
THR	%	0.71	**0.714**	100.00
TRP	%	0.00	**0.241**	100.00
VAL	%	0.00	**0.889**	100.00

9-12 weeks

Diet Name: **HF Control 9-12**

Feed Cost: $ 226.6372

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**55.427**	100.00	1108.54
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**23.808**	100.00	476.16
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**8.000**	8.00	160.00
Oil (other)	28.75	1.00	**4.030**	8.00	80.60
CA Tmineral Mix	40.00	0.13	**0.125**	0.25	2.50
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.010**	100.00	0.20
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.000**	100.00	0.00
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.054**	100.00	1.07
Lysine HCL	132.00	0.00	**0.072**	100.00	1.44
Threonine	211.70	0.00	**0.000**	100.00	0.00
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**89.380**	100.00
Metabolozable Energy	Kcal/kg	3175.00	**3175.000**	10000.00
Protein	%	22.00	**22.000**	100.00
Ether Extract	%	0.00	**7.814**	100.00
Linoleic Acid	%	1.00	**1.707**	100.00
Crude Fiber	%	0.00	**2.876**	100.00
Calcium	%	0.90	**0.912**	100.00
Total Phosphorus	%	0.00	**0.770**	100.00
Avail. Phosphorus	%	0.45	**0.450**	100.00
Potassium	%	0.00	**0.806**	100.00
Chlorine	%	0.00	**0.283**	100.00
Manganese	mg/kg	0.00	**1327.187**	5000.00
Sodium	%	0.00	**0.227**	100.00
Zinc	mg/kg	0.00	**1346.931**	10000.00
Iron	mg/kg	0.00	**858.057**	5000.00
Copper	mg/kg	0.00	**25.580**	5000.00
Selenium	mg/kg	0.00	**0.167**	5000.00
Magnesium	mg/kg	0.00	**0.243**	5000.00
Sulfur	%	0.00	**0.214**	100.00
Vitamin E	mg/kg	0.00	**24.438**	5000.00
Thiamin	mg/kg	0.00	**3.548**	5000.00
Riboflavin	mg/kg	0.00	**5.585**	5000.00
Niacin	mg/kg	0.00	**41.650**	5000.00
Pyridoxine	mg/kg	0.00	**6.270**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.610**	5000.00
Biotin	mg/kg	0.00	**48.137**	5000.00
Choline	mg/kg	1100.00	**1346.049**	5000.00
Folate	mg/kg	0.00	**0.899**	5000.00
ARG	%	0.00	**1.322**	100.00
GLY	%	0.00	**1.062**	100.00
SER	%	0.00	**0.933**	100.00
GLY&SER	%	0.00	**1.996**	100.00
HIS	%	0.00	**0.516**	100.00
ILE	%	0.00	**0.740**	100.00
LEU	%	0.00	**1.697**	100.00
LYS	%	1.04	**1.040**	100.00
MET	%	0.00	**0.359**	100.00
CYS	%	0.00	**0.265**	100.00
TSAA	%	0.62	**0.624**	100.00
PHE	%	0.00	**0.883**	100.00
TYR	%	0.00	**0.656**	100.00
TAAA	%	0.00	**1.533**	100.00
THR	%	0.62	**0.642**	100.00
TRP	%	0.00	**0.215**	100.00
VAL	%	0.00	**0.821**	100.00

12-15 weeks

Diet Name: 12-15 Wk

Feed Cost: $ 223.4063

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**59.335**	100.00	1186.69
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**20.629**	100.00	412.57
Porkmeal (Digestible20	19.00	0.00	**6.679**	8.00	133.59
Corn DDGS (Digestible	6.00	0.00	**8.000**	8.00	160.00
Oil (other)	28.75	1.00	**4.757**	8.00	95.14
CA Tmineral Mix	40.00	0.00	**0.000**	0.00	0.00
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.000**	100.00	0.00
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.000**	100.00	0.00
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.000**	100.00	0.00
Lysine HCL	132.00	0.00	**0.000**	100.00	0.00
Threonine	211.70	0.00	**0.000**	100.00	0.00
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
Premix (Nutra Blend)	340.00	0.13	**0.125**	0.13	2.50
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**89.307**	100.00
Metabolozable Energy	Kcal/kg	3250.00	**3250.000**	10000.00
Protein	%	20.00	**20.000**	100.00
Ether Extract	%	0.00	**8.511**	100.00
Linoleic Acid	%	1.00	**1.776**	100.00
Crude Fiber	%	0.00	**2.838**	100.00
Calcium	%	0.75	**0.750**	100.00
Total Phosphorus	%	0.00	**0.692**	100.00
Avail. Phosphorus	%	0.38	**0.391**	100.00
Potassium	%	0.00	**0.735**	100.00
Chlorine	%	0.00	**0.274**	100.00
Manganese	mg/kg	0.00	**1200.879**	5000.00
Sodium	%	0.00	**0.218**	100.00
Zinc	mg/kg	0.00	**1219.638**	10000.00
Iron	mg/kg	0.00	**709.548**	5000.00
Copper	mg/kg	0.00	**20.818**	5000.00
Selenium	mg/kg	0.00	**0.236**	5000.00
Magnesium	mg/kg	0.00	**0.223**	5000.00
Sulfur	%	0.00	**0.196**	100.00
Vitamin E	mg/kg	0.00	**33.449**	5000.00
Thiamin	mg/kg	0.00	**4.122**	5000.00
Riboflavin	mg/kg	0.00	**8.777**	5000.00
Niacin	mg/kg	0.00	**72.531**	5000.00
Pyridoxine	mg/kg	0.00	**6.903**	5000.00
Vitamin B-12	mcg/kg	0.00	**10.198**	5000.00
Biotin	mg/kg	0.00	**48.144**	5000.00
Choline	mg/kg	0.00	**1449.827**	5000.00
Folate	mg/kg	0.00	**1.213**	5000.00
ARG	%	0.00	**1.185**	100.00
GLY	%	0.00	**0.941**	100.00
SER	%	0.00	**0.854**	100.00
GLY&SER	%	0.00	**1.796**	100.00
HIS	%	0.00	**0.473**	100.00
ILE	%	0.00	**0.675**	100.00
LEU	%	0.00	**1.593**	100.00
LYS	%	0.85	**0.873**	100.00
MET	%	0.00	**0.285**	100.00
CYS	%	0.00	**0.251**	100.00
TSAA	%	0.53	**0.536**	100.00
PHE	%	0.00	**0.812**	100.00
TYR	%	0.00	**0.603**	100.00
TAAA	%	0.00	**1.409**	100.00
THR	%	0.54	**0.584**	100.00
TRP	%	0.00	**0.194**	100.00
VAL	%	0.00	**0.751**	100.00

15-18 weeks

Diet Name: **HF Control 15-18**

Feed Cost: $ 213.2140

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**62.641**	100.00	1252.83
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**14.435**	100.00	288.70
Porkmeal (Digestible20	19.00	0.00	**8.000**	8.00	160.00
Corn DDGS (Digestible	6.00	0.00	**8.000**	8.00	160.00
Yellow Grease	28.75	1.00	**5.808**	8.00	116.16
CA Tmineral Mix	40.00	0.13	**0.125**	0.25	2.50
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.366**	100.00	7.33
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.143**	100.00	2.86
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.006**	100.00	0.13
Lysine HCL	132.00	0.00	**0.000**	100.00	0.00
Threonine	211.70	0.00	**0.000**	100.00	0.00
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**88.855**	100.00
Metabolozable Energy	Kcal/kg	3325.00	**3325.000**	10000.00
Protein	%	18.00	**18.000**	100.00
Ether Extract	%	0.00	**9.736**	100.00
Linoleic Acid	%	0.90	**1.829**	100.00
Crude Fiber	%	0.00	**2.669**	100.00
Calcium	%	1.01	**1.010**	100.00
Total Phosphorus	%	0.00	**0.807**	100.00
Avail. Phosphorus	%	0.51	**0.510**	100.00
Potassium	%	0.00	**0.642**	100.00
Chlorine	%	0.00	**0.281**	100.00
Manganese	mg/kg	0.00	**1324.731**	5000.00
Sodium	%	0.00	**0.227**	100.00
Zinc	mg/kg	0.00	**1343.787**	10000.00
Iron	mg/kg	0.00	**880.311**	5000.00
Copper	mg/kg	0.00	**24.444**	5000.00
Selenium	mg/kg	0.00	**0.159**	5000.00
Magnesium	mg/kg	0.00	**0.228**	5000.00
Sulfur	%	0.00	**0.183**	100.00
Vitamin E	mg/kg	0.00	**25.744**	5000.00
Thiamin	mg/kg	0.00	**3.500**	5000.00
Riboflavin	mg/kg	0.00	**5.385**	5000.00
Niacin	mg/kg	0.00	**41.320**	5000.00
Pyridoxine	mg/kg	0.00	**6.307**	5000.00
Vitamin B-12	mcg/kg	0.00	**5.610**	5000.00
Biotin	mg/kg	0.00	**48.111**	5000.00
Choline	mg/kg	0.00	**1134.807**	5000.00
Folate	mg/kg	0.00	**0.806**	5000.00
ARG	%	0.00	**1.039**	100.00
GLY	%	0.00	**0.918**	100.00
SER	%	0.00	**0.756**	100.00
GLY&SER	%	0.00	**1.675**	100.00
HIS	%	0.00	**0.421**	100.00
ILE	%	0.00	**0.586**	100.00
LEU	%	0.00	**1.466**	100.00
LYS	%	0.74	**0.750**	100.00
MET	%	0.00	**0.272**	100.00
CYS	%	0.00	**0.228**	100.00
TSAA	%	0.50	**0.500**	100.00
PHE	%	0.00	**0.723**	100.00
TYR	%	0.00	**0.527**	100.00
TAAA	%	0.00	**1.243**	100.00
THR	%	0.51	**0.522**	100.00
TRP	%	0.00	**0.163**	100.00
VAL	%	0.00	**0.679**	100.00

18-20 weeks

Diet Name: **HF Control 18-21**

Feed Cost: $ 211.7323

Ingredient	Cost $/cwt	Min. %	Amount %	Max. %	Lbs. per ton
Corn (Digestible2011)	6.59	0.00	**67.487**	100.00	1349.74
Poultry BP meal	18.75	0.00	**0.000**	0.00	0.00
Soy (Digestible1998)	17.00	0.00	**14.359**	100.00	287.18
Porkmeal (Digestible20	19.00	0.00	**5.000**	5.00	100.00
Corn DDGS (Digestible	6.00	0.00	**5.000**	5.00	100.00
Oil (other)	28.75	1.00	**6.637**	8.00	132.73
CA Tmineral Mix	40.00	0.13	**0.125**	0.25	2.50
Poultry Vit Premix	50.00	0.13	**0.125**	0.25	2.50
Dicalcium Phosphate	34.40	0.00	**0.500**	100.00	9.99
Sodium Bicarbonate	40.00	0.00	**0.000**	100.00	0.00
Sodium Chloride	8.00	0.30	**0.300**	0.35	6.00
Limestone	5.50	0.00	**0.377**	100.00	7.55
Choline Cl	62.50	0.00	**0.000**	100.00	0.00
DL-Methionine	211.70	0.00	**0.041**	100.00	0.81
Lysine HCL	132.00	0.00	**0.000**	100.00	0.00
Threonine	211.70	0.00	**0.000**	100.00	0.00
Avatec	250.00	0.05	**0.050**	0.05	1.00
Valine	200.00	0.00	**0.000**	100.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
0	0.00	0.00	**0.000**	0.00	0.00
TOTAL			**100.000**		

Nutrient	Units	Min.	Amount	Max.
Dry Matter	%	0.00	**88.296**	100.00
Metabolozable Energy	Kcal/kg	3400.00	**3400.000**	10000.00
Protein	%	16.00	**16.000**	100.00
Ether Extract	%	0.00	**10.162**	100.00
Linoleic Acid	%	0.90	**1.788**	100.00
Crude Fiber	%	0.00	**2.500**	100.00
Calcium	%	0.82	**0.820**	100.00
Total Phosphorus	%	0.00	**0.674**	100.00
Avail. Phosphorus	%	0.41	**0.410**	100.00
Potassium	%	0.00	**0.592**	100.00
Chlorine	%	0.00	**0.257**	100.00
Manganese	mg/kg	0.00	**1324.297**	5000.00
Sodium	%	0.00	**0.193**	100.00
Zinc	mg/kg	0.00	**1339.694**	10000.00
Iron	mg/kg	0.00	**875.943**	5000.00
Copper	mg/kg	0.00	**22.828**	5000.00
Selenium	mg/kg	0.00	**0.142**	5000.00
Magnesium	mg/kg	0.00	**0.200**	5000.00
Sulfur	%	0.00	**0.164**	100.00
Vitamin E	mg/kg	0.00	**25.578**	5000.00
Thiamin	mg/kg	0.00	**3.557**	5000.00
Riboflavin	mg/kg	0.00	**5.041**	5000.00
Niacin	mg/kg	0.00	**38.956**	5000.00
Pyridoxine	mg/kg	0.00	**6.192**	5000.00
Vitamin B-12	mcg/kg	0.00	**3.509**	5000.00
Biotin	mg/kg	0.00	**30.110**	5000.00
Choline	mg/kg	0.00	**1102.877**	5000.00
Folate	mg/kg	0.00	**0.815**	5000.00
ARG	%	0.00	**0.918**	100.00
GLY	%	0.00	**0.733**	100.00
SER	%	0.00	**0.686**	100.00
GLY&SER	%	0.00	**1.421**	100.00
HIS	%	0.00	**0.380**	100.00
ILE	%	0.00	**0.538**	100.00
LEU	%	0.00	**1.351**	100.00
LYS	%	0.63	**0.661**	100.00
MET	%	0.00	**0.278**	100.00
CYS	%	0.00	**0.212**	100.00
TSAA	%	0.49	**0.490**	100.00
PHE	%	0.00	**0.657**	100.00
TYR	%	0.00	**0.487**	100.00
TAAA	%	0.00	**1.137**	100.00
THR	%	0.44	**0.462**	100.00
TRP	%	0.00	**0.151**	100.00
VAL	%	0.00	**0.603**	100.00

Yellow grease

Sender: Dr. Jeffre Firman **Date Received:** March 7, 2016
Address: University of Missouri
Lab 116A, ASRC, Columbia, MO 65211
Phone: 573-882-9427
Purchase Order #: **Date of Report:** March 28, 2016
Description: Yellow Grease **Page 1 of 2**

ESCL #	UMC ID	Moisture W/W%	Insolubles W/W%	Unsaponifiables W/W%
3760	Batch 1	0.78	0.11	0.14
3761	Batch 2	1.27	0.78	0.08
3762	Batch 3	0.68	0.05	0.02
3763	Batch 4	1.20	0.07	0.15

ESCL #	UMC ID	Crude Fat W/W%	Iodine Value
3760	Batch 1	99.25	110.54
3761	Batch 2	98.02	105.03
3762	Batch 3	99.07	106.23
3763	Batch 4	98.70	107.50

Proximates		CP	Moisture	Fat	Fiber	Ash
3750	Turkey Control	31.12	7.79	7.07	2.34	6.53
3751	Turkey 3-6	28.36	8.03	7.17	2.37	6.45
3752	Turkey 6%	30.11	7.80	8.67	2.25	7.16
3753	Turkey 12-15	20.48	8.03	8.26	2.35	4.92
3754	Turkey 9-12	23.21	8.03	7.14	2.43	5.25
3755	Turkey 6-9	25.18	7.29	7.39	2.63	5.96
3756	Turkey 8%	28.87	7.40	11.14	2.80	7.50
3757	Turkey 15-18	18.80	9.40	8.97	2.65	5.43
3758	Turkey 18-21	16.99	10.89	9.27	2.21	4.66