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Utilization of High Levels of Ruminant By-products in Turkey Rations

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Introduction:

Traditionally by-products have been limited to not more than 8% of the ration when used singly, or 10 to 15% when used in combination (Firman, 1996). This limitation is caused by the inconsistent AA digestibilities between batches of meat and bone meal (MBM) or other by-products. Sibbald (1986) reported AA digestibilities that differed significantly between batches of MBM. Parsons (1997) reported a wide range of AA digestibilities for commercially rendered MBM samples that were processed at different temperatures. In order to use these feedstuffs most effectively, formulation of diets on a digestible basis is needed. Once AA digestibilities are determined, the MBM can then be included to meet AA requirements and provide maximal growth (Rostagno et al., 1995; Baker et al., 1981). Wang and Parsons reported in 1998 that chick performance was not affected by a 20% inclusion of high quality MBM when digestible formulation was used. However, very little research has been conducted using digestible formulation to include MBM at high levels in turkey rations.

As of August, 1997 feed manufacturers were no longer able to utilize by-products which contained tissue from the nervous system or other non-meat parts of ruminant animals in ruminant rations (FDA). This restriction should increase the availability of these by-products to turkey feed manufacturers and could also by accompanied by lower costs. These experiments were conducted to examine the effects of utilizing high levels of ruminant meat and bone meal (RMBM) in turkey rations.

Materials and Methods:

Two experiments were conducted using 1500 Nicholas white tom turkeys which were randomized and assigned to six dietary treatment groups in a randomized complete block design with 5 replicates. In both experiments the diets were formulated on a digestible basis using procedures previously published by this lab. The diets consisted of a positive control and rations containing 0, 10, 20, 30, 40, and 50% of the protein source from RMBM. Vitamin and trace mineral levels were increased to protect against any potential absorption problems caused by excess Ca and/or P in treatments containing the highest levels of RMBM. All birds were housed in commercial-type conditions in floor pens with curtain-sided buildings. Performance data was collected every three weeks and included weight gain and feed:gain. Mortality was calculated daily. All data was analyzed by ANOVA using $P<.05$ as the level of significance.

Results:

Experiment 1

Performance data can be found in Tables 1. In the first experiment there were few differences between treatments with a trend toward slight increases in performance when by-products were added to the diets. By 18 weeks, no differences in performance were observed. No significant differences were noted in the carcass data for all treatments except for the fat pad. At the 50% replacement level the fat pad percent was significantly higher when compared to all other treatments. Mortality was analyzed but not found to be significant .

Experiment 2

Performance data can be found in Table 2. Additions of low levels of RMBM showed slight increases in weight gain relative to the 0% additions with slight depressions in growth at the higher inclusion rates. No differences were observed by 18 wks. Feed:gain was generally improved at higher RMBM inclusion rates although this may be a function of the slightly reduced body weights observed. There was no significant difference ($P<.05$) in carcass yield with the exception of the fad pad which was significantly ($P<.05$) larger at the highest inclusion levels.

Discussion:

The differences in weight gains can most likely be attributed to the improved AA profile the RMBM provides when included in these rations. The possibility of an unknown increase in dietary energy in the rations containing the RMBM must also be considered. Dale (1997) reported that high levels of minerals such as calcium and phosphorus found in MBM may cause a false decrease in TME values. However, in a typical diet that contained 15% RMBM with a TME which was underestimated by 5%, the resultant change in energy content of the diet would be less than 1%

Diet formulation on an digestible rather that a total AA basis is essential when trying to maximize the value of any by-product feed. These data indicate that up to 50% of the protein source can be replaced. However, it is important to note the SBM replacement over twenty percent results in increased dietary calcium and phosphorus levels as well as difficulty in maintaining the calcium to phosphorus ratio. Even though performance was not affected by these changes in these experiments, potential problems could exist if dietary vitamin and trace mineral levels were not increased. Replacing SBM at levels exceeding 20% could also become impractical as tighter restrictions are placed on phosphorus excretion by poultry.

References

Baker, D.H., R.C. Bltenthal, D.P. Boebel, G.L. Czarnecki, L.L Southern, and G.M. Willis. 1981. Protein-Amino acid evaluation of steam-processed feather meal. Poultry Science. 60:1865.

Eissler, C.R., and J.D. Firman. 1996. Effects of feather meal on the performance of turkeys. Journal Applied Poultry Science, Inc. 5:246.

Parsons, C.M., F. Castanon, and Y. Han. 1997. Protein and amino acid quality of meat and bone meal. Poultry Science. 76:361.

Pesti G.M., L.O. Faust, H.L. Fuller, N.M. Dale, and F.H. Benoff. 1986 (1987). Nutritive value of poultry by-product meal 1. Metabolizable energy value as influenced by method of determination and level of substitution. Poultry Science. 65:2758.

Rostagno, H.S. and W.A. Barbosa. 1995. Biological efficacy and absorption of DL-methionine hydroxy analogue free acid compared to DL-methionine in chickens as affected by heat stress. British Poultry Science. 36:303.

Sibbald, I.R. 1986. the TME system of feed evaluation: Methodology, feed consumption data and bibliography. Tech. Bull. 1986-4e Agric. Canada.

Wang X. and C.M. Parsons. 1998. Effect of raw material source, processing systems, and processing temperatures on amino acid digestibility of meat and bone meals. Poultry Science. 77:834.

TABLE 1. UTILIZATION OF HIGH LEVELS OF RUMINANT BY-PRODUCT MEAL
IN TOM RATIONS TO 18 Weeks
Experiment 1

Treatment % SBM replacement	F:G/Livability						
	3 wks	6 wks	9 wks	12 wks	15 wks	18 wks	Livability %
0	1.57	1.95	1.86	2.13[abc]	2.50	2.79	89.2
10	1.60	1.99	1.89	2.19[a]	2.56	2.86	86.0
20	1.59	1.94	1.85	2.16[ab]	2.49	2.77	85.0
30	1.54	2.05	1.86	2.10[cd]	2.47	2.68	79.5
40	1.53	1.99	1.85	2.05[d]	2.46	2.74	82.0
50	1.47	1.97	1.81	2.05[d]	2.41	2.66	79.5
S.E.	.034	.032	.020	.021	.034	.045	2.89

Treatment % SBM replacement	Avg. Gain					
	3 wks	6 wks	9 wks	12 wks	15 wks	18 wks
0	1.20	3.81[c]	9.09[e]	15.81[b]	23.25	31.42
10	1.23	4.02[ab]	9.70[ab]	16.47[a]	24.29	32.66
20	1.23	4.07[a]	9.80[a]	16.65[a]	23.96	32.18
30	1.20	3.92[abc]	9.64[abc]	16.69[a]	23.66	32.35
40	1.20	3.74[c]	9.26[cde]	16.42[a]	23.79	32.14
50	1.22	3.92[abc]	9.58[abcd]	16.75[a]	24.12	32.61
S.E.	.0199	.068	.136	.156	.385	.394

Treatment % SBM replacement	% Carcass Yields at 18 Weeks Mean Response[1]						
	Dress	Major	Minor	Leg	Thigh	Wing	Fat Pad*
0 - Control	76.88	23.2	5.9	13.8	15.0	12.3	1.63[a]
10	78.19	23.6	6.0	13.1	14.8	12.2	1.53[a]
20	78.02	24.1	6.0	13.2	14.4	12.7	1.55[a]
30	79.36	23.6	6.1	13.2	15.3	12.5	1.70[a]
40	78.02	22.5	6.0	13.3	15.2	12.5	1.76[a]
50	78.00	22.9	6.0	13.1	15.0	12.0	2.19[b]
S.E.	.549	.522	.132	.216	.305	.200	.125

[1]Means followed by no common letters are significantly different.

TABLE 2. UTILIZATION OF HIGH LEVELS OF RUMINANT BY-PRODUCT MEAL IN TOM RATIONS TO 18 Weeks
Experiment 2

Treatment	Mean Response Gain[1] and Livability						
% SBM replacement	3 wks	6 wks	9 wks	12 wks	15 wks	18 wks	Livability %
0	1.04^{c}	3.47	8.84^{ab}	16.23^{a}	22.91^{abc}	31.31	.89
10	1.14^{a}	3.58	9.19^{a}	16.46^{a}	23.59^{a}	31.88	.88
20	1.08^{bc}	3.35	8.62^{abc}	15.94^{ab}	23.07^{ab}	31.32	.88
30	1.12^{ab}	3.38	8.62^{abc}	15.74^{abc}	22.79^{abc}	30.90	.91
40	1.10^{ab}	3.28	8.45^{bc}	15.33^{bc}	22.52^{bc}	30.89	.94
50	1.10^{ab}	3.26	8.11^{c}	15.02^{c}	21.95^{c}	30.78	.88
SE	.016	.091	.209	.282	.337	.387	.021

Treatment	Mean Response Feed:Grain[1]					
% SBM replacement	3 wks	6 wks	9 wks	12 wks	15 wks	18 wks
0	1.71^{a}	1.84	2.05	2.20	2.60^{a}	2.83^{a}
10	1.58^{cd}	1.81	2.02	2.18	2.51^{ab}	2.79^{a}
20	1.61^{bc}	1.80	2.02	2.19	2.51^{ab}	2.72^{abc}
30	1.62^{b}	1.83	1.98	2.17	2.47^{ab}	2.73^{ab}
40	1.59^{bcd}	1.79	1.95	2.12	2.38^{b}	2.63^{bc}
50	1.53^{b}	1.79	2.10	2.21	2.43^{b}	2.61^{c}
SE	.014	.025	.038	.034	.045	.039

Treatment	% Carcass Yields at 18 Weeks Mean Response[1]						
% SBM replacement	Dress	Major	Minor	Leg	Thigh	Wing	Fat Pad*
0 - Control	77.24	22.86	5.83	12.63	15.76	12.43	1.91^{bc}
10	76.03	22.97	6.11	13.01	15.38	12.65	1.77^{c}
20	78.22	24.05	5.81	12.44	14.84	12.71	1.95^{bc}
30	77.19	24.23	5.96	12.63	15.20	12.80	1.88^{bc}
40	77.75	23.46	5.93	12.71	15.20	12.54	2.21^{ab}
50	77.76	23.45	5.91	12.50	14.57	12.09	2.34^{a}
SE	.899	.454	.089	.199	.335	.193	.114

[1]Means followed by no common letters are significantly different.