FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

FRED D. BISPLINGHOFF, D.V.M.
Director Technical Services

7150 ESTERO BLVD. • APT. 906
FT. MYERS BEACH, FL 33931
AREA CODE 813 — 463-4744

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NEW NUTRITIONAL EVALUATION OF BLOOD MEAL AND FEATHER MEAL FOR TURKEYS

Fred D. Bisplinghoff, D.V.M.

INTRODUCTION

In 1988 Drs. J. K. Liu, P. E. Waibel and S. L. Noll of the University of Minnesota obtained three samples each of commercial blood meal and feather meal from Minnesota producers. The purpose of the study was to determine the true amino acid availability and true metabolizable energy$_n$ contents of the six samples using large white male turkeys at 8 weeks of age.

Blood meal and feather meal have long served as alternate animal feed supplements but questionable amino acid balance and availability in both ingredients have limited their feeding use. Roth (1942) found that feather meal was deficient in tryptophan, methionine and histidine when fed to rats. An excess of cystine is believed to be another factor responsible for the poor utilization of feather meal.

Fisher (1968) determined that blood meal was deficient in isoleucine, methionine and arginine.

Waibel et al (1977) found that processing conditions affect amino acid availability. They observed 0 to 43% lysine availability in vat-dried blood meal and 80 to 97% lysine availability in ring-dried blood meal.

BLOOD MEAL

Sample Number One consisted of blood, ring-dried of mixed beef and

hog origin; it was steam coagulated, filtered and the residue dried in a ring drier at a minimum of 260 C. Sample Number Two was blood spray dried, of mixed beef and hog origin; it was evaporated under vacuum to 35% solids, than sprayed by disk atomizer into a vertical silo-type drier at 57 C. Sample Number Three was blood, ring dried as Number One, except that the origin was mixed turkey and beef blood.

Composition of selected nutrients and amino acids of the three blood meal samples is given in Table One. Differences were observed but cannot be explained at this time.

Average True Amino Acid Availability in the blood meal samples were somewhat variable (Table 2), ranging from 73.8 (isoleucine) to 91.0% (arginine). Lysine availability ranged from 85.0 to 94.1% for the three samples. The True Amino Acid Availability values were all higher in Sample Two, which was of spray origin, but Sample One had a higher level of lysine. The high True Amino Acid Availability values were accompanied by greater true metabolizable $energy_n$ content (Sample 2). The main supplier of energy in blood meal is its $amino\ acid\ content_n$. The true metabolizable $energy_n$ could be high (Sample 2) due to its greater amino acid availability. The True Metabolizable $Energy_n$ values averaged 3,458 kcal/kg on a dry matter basis, which is within the range of values obtained by Sibbald (1986), from 3,344 to 3,870 kcal/kg. A positive linear relationship was found between True Metabolizable $Energy_n$ and True Amino Acid Availability of the blood samples, suggesting the possibility of approximating the estimation of one from the other.

FEATHER MEAL

The composition of amino acids of three feather meal samples are shown in Table One. The average value for tyrosine in feather meal was 2.08% compared with the value of 6.31% in the 1984 NRC nutrient composition tables. Other investigators have found similar values in both batch and continuous process feather meal. The tyrosine content of feather meal as indicated in NRC (1984) may not be representative.

The True Amino Acid Availability and True Metabolizable $Energy_n$ values of feather meal are given in Table Three. Average True Amino Acid Availability values ranged from 59.2 (lysine) to 82.8% (arginine). The overall mean was

73.2%. These values are lower than some previous studies but compare closely with a F.P.R.F. study by Nordheim and Coon (1984) who found 60.5 and 77.4% lysine availability by chick bioassay and digestible lysine study, respectively.

The True Amino Acid Availabity values of different sample sources have means of 72.2, 71.9 and 75.6% for Samples four, five and six, respectively (Table 3). Sources of feather meal were somewhat variable in True Metabolizable $Energy_n$ content. Samples 4, 5 and 6 contained 2,930, 2,877 and 3,122 kcal/kg on a dry matter basis, respectively. As with blood meals, there was a positive relationship between True Amino Acid Availability and True Metabolizable Energy. Sibbald (1986) summarized some True Metabolizable $Energy_n$ data for feather meal and the values ranged from 3,153 to 3,727 kcal/kg on a dry matter basis. Different sources and amino acid digestibilities may contribute to these differences.

One of the great needs in poultry nutrition is to be able to estimate available energy and amino acids in ingredients, especially those of animal origin. A correlation coefficient of .88 suggested a very strong relationship between True Metabolizable $Energy_n$ and True Amino Acid Availability in the six samples tested. This relationship, if confirmed, suggested that one laboratory determination may provide information to estimate True Metabolizable $Energy_n$ and True Amino Acid Availability values simultaneously for high protein ingredients like blood meal and feather meal, because the primary source of energy comes from digestible amino acids contained therein.

TABLE 1. *Composition of blood and feather meals on as-fed basis*

Nutrient	Blood meal				Feather meal			
	1	2	3	$\bar{x}$	4	5	6	$\bar{x}$
	(%)							
Moisture	8.50	6.10	4.70	6.43	4.60	2.00	6.40	4.33
Protein (N × 6.25)	89.6	89.5	92.1	90.4	90.2	91.6	81.8	87.9
Fiber, crude	.80	.20	.70	.57	.40	.50	.70	.53
Fat	.10	.10	.90	.37	4.40	3.90	5.40	4.57
Ash	1.47	3.83	2.04	2.45	2.03	2.32	5.93	3.43
Calcium	.16	.17	.44	.26	.35	.88	1.25	.83
Phosphorus	.06	.15	.26	.16	.19	.30	.45	.31
Aspartic acid	9.00	9.85	9.88	9.58	6.25	6.13	5.63	6.00
Threonine	4.08	4.03	4.11	4.07	3.48	3.86	3.20	3.51
Serine	4.36	4.14	4.79	4.43	7.12	9.30	8.52	8.31
Glutamic acid	8.34	7.80	9.14	8.43	9.34	9.42	9.13	9.30
Glycine	3.88	4.04	4.19	4.04	6.82	8.42	6.64	7.29
Alanine	6.82	7.36	7.45	7.21	4.69	4.54	3.81	4.35
Cystine	1.20	1.02	1.32	1.18	5.21	5.37	3.54	4.71
Valine	8.28	8.54	8.16	8.33	7.63	7.55	6.06	7.08
Methionine	1.58	1.43	1.64	1.55	.77	.76	.75	.76
Isoleucine	1.05	.93	1.51	1.16	4.02	4.18	3.40	3.87
Leucine	10.87	11.09	10.88	10.95	7.26	7.27	6.34	6.96
Tyrosine	2.64	2.37	2.53	2.51	2.14	2.06	2.03	2.08
Phenylalanine	6.52	6.37	6.34	6.41	4.42	4.47	4.34	4.41
Histidine	5.20	5.79	5.20	5.40	1.24	0.61	1.06	.97
Lysine	9.09	8.50	8.20	8.60	1.82	1.36	1.83	1.67
Arginine	3.67	3.71	4.35	3.94	5.94	6.06	5.41	5.80

TABLE 2. *True amino acid availabilities (TAAA) and metabolizable energy values of blood meals of Samples 1, 2, and 3 ($\bar{x}$ ± SE)*

Nutrient	1	2	3	$\bar{x}$
	(%)			
TAAA				
Aspartic acid	88.1 ± 1.1	93.8 ± 1.0	84.8 ± 1.8	88.9 ± 1.3
Threonine	86.0 ± 1.4	91.1 ± 1.3	82.9 ± 2.2	86.7 ± 1.6
Serine	88.7 ± 1.2	92.6 ± 1.0	87.0 ± 1.3	89.5 ± 1.2
Glutamic acid	84.8 ± .8	91.3 ± 1.3	80.7 ± 2.7	85.6 ± 1.6
Alanine	87.4 ± .9	93.3 ± 1.1	82.7 ± 2.0	87.8 ± 1.3
Cystine	80.3 ± 2.9	84.1 ± 2.3	71.3 ± 5.7	78.6 ± 3.6
Valine	85.1 ± .8	92.5 ± 1.2	81.3 ± 1.7	86.3 ± 1.2
Methionine	87.8 ± 1.3	91.0 ± .7	85.0 ± 2.0	88.0 ± 1.3
Isoleucine	73.5 ± 2.9	77.4 ± 3.7	70.6 ± 2.3	73.8 ± 3.0
Leucine	87.4 ± .7	94.1 ± .8	84.6 ± 1.6	88.7 ± 1.0
Tyrosine	88.3 ± .9	94.6 ± 1.1	85.8 ± 2.0	89.6 ± 1.3
Phenylalanine	87.5 ± .5	93.8 ± .9	83.0 ± 2.2	88.1 ± 1.2
Histidine	86.7 ± .8	92.4 ± .6	81.1 ± 2.9	86.8 ± 1.4
Lysine	89.6 ± .4	94.1 ± .7	85.0 ± 1.4	89.6 ± .8
Arginine	90.2 ± 1.4	92.8 ± 1.1	90.0 ± 1.1	91.0 ± 1.2
$\bar{x}$	86.1 ± 1.2	91.3 ± 1.3	82.3 ± 2.2	86.6 ± 1.5
Energy, kcal ME/kg (DM basis)				
Gross	5,796	5,635	5,899	5,777
TME_n	3,426 ± 58	3,677 ± 37	3,270 ± 74	3,458 ± 57

TABLE 3. *True amino acid availabilities (TAAA) and metabolizable energy values of feather meals, Samples 4, 5, and 6 ($\bar{x} \pm SE$)*

Nutrient	4	5	6	$\bar{x}$
	(%)			
TAAA				
Aspartic acid	62.1 ± 2.2	64.0 ± 2.5	60.9 ± 1.4	62.4 ± 2.0
Threonine	70.4 ± 2.1	71.6 ± 2.4	73.7 ± 1.4	71.9 ± 2.0
Serine	75.7 ± 2.2	80.1 ± 2.1	83.8 ± 1.2	79.9 ± 1.8
Glutamic acid	71.8 ± 1.9	69.5 ± 2.0	72.7 ± 2.7	71.3 ± 2.2
Alanine	73.2 ± 1.6	72.4 ± 2.0	88.0 ± 1.3	77.9 ± 1.6
Cystine	64.2 ± 3.7	64.6 ± 3.1	63.9 ± 4.1	64.2 ± 3.6
Valine	77.2 ± 1.5	76.8 ± 1.9	77.1 ± 2.5	77.0 ± 2.0
Methionine	73.7 ± 4.9	72.7 ± 3.5	76.9 ± 4.1	74.4 ± 4.1
Isoleucine	80.3 ± 1.5	80.1 ± 1.9	82.4 ± 2.2	81.0 ± 1.9
Leucine	75.5 ± 1.8	76.4 ± 1.9	78.9 ± 2.7	76.9 ± 2.1
Tyrosine	74.5 ± 1.0	78.8 ± 4.5	75.9 ± 2.7	76.4 ± 2.8
Phenylalanine	76.6 ± 1.5	78.9 ± 1.9	82.0 ± 2.5	79.2 ± 2.0
Histidine	65.0 ± 2.0	59.8 ± 3.4	67.3 ± 2.8	64.1 ± 2.7
Lysine	60.5 ± 1.8	51.0 ± 3.5	65.8 ± 2.5	59.2 ± 2.6
Arginine	82.4 ± 2.0	82.0 ± 1.4	84.1 ± 2.1	82.8 ± 1.8
$\bar{x}$	72.2 ± 2.1	71.9 ± 2.5	75.6 ± 2.4	73.2 ± 2.4
Energy, kcal ME/kg (DM basis)				
Gross	5,546	5,611	5,581	5,579
TME_n	2,930 ± 72	2,877 ± 49	3,122 ± 62	2,976 ± 61

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