**Supplementary material S1**

Composition and calculated and analyzed nutrients of test diet for Experiment 1 and basal diets for Experiment 2

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Test1 | Control | 8%fat | 12%fat | 16%Fat2 | 26%CP | 28.5%CP | 31%CP | 14%NDF | 16%NDF | 18%NDF |
|  |  | ( C ) |  |  | ( HF ) |  |  | ( HP ) |  |  | ( HFi ) |
| Ingredients, as fed (g/kg) |  |  |  |  |  |  |  |  |  |  |  |
|  Corn | 245 | 535 | 463 | 391 | 319 | 484 | 433 | 382 | 356 | 178 | 0 |
|  Soybean meal (46% CP) | 220 | 351 | 376 | 400 | 425 | 384 | 417 | 450 | 319 | 286 | 254 |
|  Barley | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 212 | 423 | 635 |
|  Wheat | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  Pro-Plus603 | 50 | 51 | 63 | 74 | 86 | 76 | 101 | 126 | 55 | 59 | 63 |
|  Poultry oil | 25 | 28 | 63 | 99 | 135 | 26 | 25 | 23 | 24 | 20 | 16 |
|  L-Threonine (99%) | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 |
|  Dl-Methionine (98%) | 2.2 | 2.6 | 2.8 | 3.1 | 3.3 | 3.0 | 3.3 | 3.7 | 2.7 | 2.8 | 2.9 |
|  Lysine HCl (74.4%) | 1.7 | 0.7 | 0.5 | 0.2 | 0.0 | 0.6 | 0.5 | 0.4 | 0.9 | 1.1 | 1.3 |
|  Defluorinated phosphate | 10.7 | 17.0 | 16.5 | 16.1 | 15.6 | 11.9 | 6.8 | 1.7 | 15.3 | 13.7 | 12.0 |
|  Limestone | 6.4 | 5.5 | 5.3 | 5.1 | 4.9 | 5.0 | 4.4 | 3.9 | 5.7 | 6.0 | 6.2 |
|  Salt | 2.7 | 3.1 | 3.2 | 3.2 | 3.3 | 3.0 | 3.0 | 2.9 | 3.1 | 3.2 | 3.2 |
|  Choline chloride (60%) | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
|  Trace Min-Vit-premix4 | 3.2 | 3.3 | 3.5 | 3.6 | 3.8 | 3.3 | 3.2 | 3.2 | 3.3 | 3.2 | 3.2 |
|  Additives5 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
|  Anticoccidial6 | 0.2 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Calculated nutrients (%) |  |  |  |  |  |  |  |  |  |  |  |
|  ME (MJ/kg) | 12.50 | 12.34 | 12.95 | 13.56 | 14.16 | 12.20 | 12.06 | 11.92 | 12.20 | 12.06 | 11.92 |
|  Crude protein (CP) | 20.64 | 23.60 | 24.77 | 25.93 | 27.10 | 26.07 | 28.53 | 31.00 | 23.33 | 23.07 | 22.80 |
|  ME/CP ((MJ/kg)/(kg/kg)) | 61 | 52 | 52 | 52 | 52 | 47 | 42 | 38 | 52 | 52 | 52 |
|  Crude fat | 4.94 | 5.50 | 8.93 | 12.37 | 15.80 | 5.47 | 5.43 | 5.40 | 5.03 | 4.57 | 4.10 |
|  NDF | 15.36 | 11.17 | 11.29 | 11.41 | 11.53 | 12.19 | 13.20 | 14.21 | 13.10 | 15.02 | 16.95 |
|  Calcium | 1.01 | 1.19 | 1.25 | 1.31 | 1.37 | 1.18 | 1.16 | 1.15 | 1.18 | 1.16 | 1.15 |
|  Available phosphorous | 0.50 | 0.60 | 0.63 | 0.65 | 0.68 | 0.59 | 0.59 | 0.58 | 0.59 | 0.59 | 0.58 |
|  Sodium | 0.20 | 0.25 | 0.26 | 0.27 | 0.28 | 0.24 | 0.24 | 0.23 | 0.24 | 0.24 | 0.23 |
|  Total lysine | 1.23 | 1.38 | 1.45 | 1.53 | 1.60 | 1.53 | 1.69 | 1.84 | 1.38 | 1.37 | 1.37 |
|  Total M+C | 0.91 | 1.05 | 1.11 | 1.16 | 1.22 | 1.17 | 1.29 | 1.41 | 1.05 | 1.04 | 1.04 |
|  Digestible lysine (dLys) | 1.07 | 1.23 | 1.29 | 1.35 | 1.41 | 1.36 | 1.49 | 1.62 | 1.22 | 1.20 | 1.19 |
|  ME/dLys ((MJ/kg/%) | 12 | 10 | 10 | 10 | 10 | 9 | 8 | 7 | 10 | 10 | 10 |
|  Digestible M+Cys (dM+Cys) | 0.79 | 0.93 | 0.98 | 1.02 | 1.07 | 1.03 | 1.12 | 1.22 | 0.92 | 0.91 | 0.90 |
|  ME/dM+Cys ((MJ/kg)/%) | 16 | 13 | 13 | 13 | 13 | 12 | 11 | 10 | 13 | 13 | 13 |
| Analyzed nutrients (%) |  |  |  |  |  |  |  |  |  |  |  |
|  Dry matter | 89.3 | 90.0 | 90.1 | 90.4 | 90.5 | 89.7 | 89.9 | 90.1 | 90.3 | 89.8 | 89.5 |
|  Crude protein | 20.1 | 23.1 | 24.2 | 27.3 | 28.6 | 26.2 | 30.5 | 31.2 | 23.2 | 23.2 | 23.1 |
|  Crude fat | 5.6 | 5.7 | 8.0 | 11.8 | 12.6 | 5.4 | 4.9 | 5.2 | 4.3 | 4.1 | 3.7 |
|  NDF | 15.9 | 11.5 | 12.9 | 15.3 | 16.0 | 12.4 | 12.5 | 13.0 | 13.8 | 16.8 | 18.1 |
|  Lysine | 1.21 | 1.34 | 1.3 | 1.49 | 1.54 | 1.4 | 1.59 | 1.74 | 1.3 | 1.25 | 1.26 |
|  Threonine |  | 0.89 | 0.87 | 1.01 | 1.04 | 0.89 | 1.05 | 1.14 | 0.87 | 0.85 | 0.87 |
|  Cysteine |  | 0.42 | 0.48 | 0.53 | 0.59 | 0.54 | 0.62 | 0.70 | 0.49 | 0.53 | 0.54 |
|  Methionine |  | 0.71 | 0.84 | 0.89 | 0.95 | 0.87 | 0.95 | 1.07 | 0.84 | 0.71 | 0.82 |
|  Leucine |   | 1.94 | 1.9 | 2.12 | 2.21 | 2.05 | 2.30 | 2.46 | 1.87 | 1.74 | 1.73 |

C = control diet, HF = high fat diet, HP = high protein diet, HFi = high fiber diet, EE = ether extract, Cys = cysteine, M = methionine, ME = metabolizable energy. All diets in experiment 2 had the following ME/nutrient ratios: ME/calcium = 10 MJ/kg/%, ME/available phosphorus = 21 MJ/kg/%,

1Test diet for Experiment 1.

2Around 3% of crude fat was lost through paper bags because the diet with 16% of fat was not able to hold in the feed.

3Blended animal protein (H.J. Baker and Bro. Inc. Stamford, CT).

4Trace Mineral-Vitamin-premix provides per kg of diet: Vitamin A 13200 IU; Vitamin E 66 IU; Vitamin D3 4950 ICU; Niacin 74.25 mg; D-panthothenic acid 33 mg; Riboflavin 20 mg; Pyridoxine 5000 mg; Thiamine 3 mg; Menadione 3 mg; Folic acid 3 mg; Biotin 0.33 mg; Vitamin B12 0.0297 mg; Mn 180 mg; Zn 150.6 mg; Fe 20.16 mg; Cu 2.04 mg; I 1.26 mg; Se 0.3 mg.

571% ofMold Curb which contains 50% of propionic acid (Kemin Industries, Inc., Des Moines, Iowa) and 29% of Ethoxyquin 66% from Monsanto sanoquin 6 (Monsanto Co., St. Louis, MO).

6Sacox 60% (Intervet, Millsboro, DE).