**Table S1**

Chemical and proximate composition of the test diets (%; of dry matter).

|  |  |
| --- | --- |
| Ingredients (%) | Dietary lysine supplementation level % |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Fish meals a | 5.00  | 5.00  | 5.00  | 5.00  | 5.00  | 5.00  |
| Rapeseed meal b | 15.00  | 15.00  | 15.00  | 15.00  | 15.00  | 15.00  |
| Soybean meal c | 17.00  | 17.00  | 17.00  | 17.00  | 17.00  | 17.00  |
| Wheat flour | 35.75  | 35.75  | 35.75  | 35.75  | 35.75  | 35.75  |
| Soybean oil | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  |
| Soybean lecithin | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
| Amino acid mix | 8.64  | 8.64  | 8.64  | 8.64  | 8.64  | 8.64  |
| Choline chloride | 0.10  | 0.10  | 0.10  | 0.10  | 0.10  | 0.10  |
| Vitamin mix d | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  |
| Mineral mix e | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  |
| Monocalcium phosphate | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  |
| Rice bran | 5.00  | 5.00  | 5.00  | 5.00  | 5.00  | 5.00  |
| Ethoxy quinoline | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| Glycine | 2.00  | 1.60  | 1.20  | 0.80  | 0.40  | 0.00  |
| L-lysine | 0.00  | 0.40  | 0.80  | 1.20  | 1.60  | 2.00  |
| Bentonite | 2.00  | 2.00  | 2.00  | 2.00  | 2.00  | 2.00  |
| Total | 100.00  | 100.00  | 100.00  | 100.00  | 100.00  | 100.00  |
| Analytical composition (Dry-matter basis) |  |  |  |  |
| Lysine (%) | 1.34  | 1.70  | 2.03  | 2.41  | 2.72  | 3.04  |
| Moisture (%) | 9.17  | 9.06  | 9.28  | 9.37  | 9.78  | 9.28  |
| Crude protein (%) | 33.21 | 33.12 | 33.15 | 33.18 | 33.15 | 33.11 |
| Crude lipid (%) | 9.00  | 8.77  | 8.68  | 8.58  | 8.92  | 8.66  |

a Fish meal, obtained from obtained from Wuxi Tongwei feedstuffs Co., Ltd.,Wuxi, China, crude protein 65.8%, crude lipid 9.5%.

b Rapeseed meal, obtained from Wuxi Tongwei feedstuffs Co., Ltd., Wuxi,China, crude protein 39.2%, crude lipid 6.1%.

c Soybean meal, obtained from Wuxi Tongwei feedstuffs Co., Ltd., Wuxi,China, crude protein 50.8%, crude lipid 4.3%.

d Vitamins premix (IU, g or mg/kg of diet): vitamin A, 25000 IU; vitamin D3,20,000 IU; vitamin e 200 mg; vitamin K3, 20 mg; thiamin, 40 mg; riboflavin,50 mg; calcium pantothenate, 100 mg; pyridoxine HCl, 40 mg; cyanocobalamin, 0.2 mg; biotin, 6 mg; folic acid, 20 mg; niacin, 200 mg; inositol,1000 mg; vitamin C, 2000 mg; choline, 2000 mg.

e Mineral mix (g/kg of diet): calciumbi phosphate, 20 g; sodium chloride,2.6 g; potassium chloride, 5 g; magnesium sulphate, 2 g; ferrous sulphate, 0.9 g; zinc sulphate, 0.06 g; cupric sulphate, 0.02 g; manganese sulphate, 0.03 g; sodium selenate, 0.02 g; cobalt chloride, 0.05 g; potassium iodide, 0.004 g, respectively, acquired from Tongwei Feed Group Co. (Jiangsu, China).