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Prediction of metabolisable energy value of broiler diets and water excretion from dietary chemical analyses

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Supplementary material (additional Tables and Figures) for:

Prediction of nutritional qualities of broiler diets from their chemical analyses: metabolisable energy value (AMEn) and water excretion.

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Tables S1a, S1b, S2a, S2b, S3, S4, S5 and Figure S1.

9 pages

Table S1a. Composition (g/kg) of experimental diets (diet numbers from 1 to 13).

Diet N°	1	2	3	4	5	6	7	8	9	10	11.1	11.2	11.3	12	13	
Trial N°	1	3	2	2	2	2	3	3	3	1	1	2	3	1	1	
Ingredients																
Maize	180.0		212.0	142.0	142.0	195.0	17.7	427.0	155.0		599.0	599.0	599.0	141.5	374.4	
Wheat	400.0	275.0	400.0	400.0	400.0	250.0	400.0	181.0	400.0	377.0				400.0	57.0	
Peas	60.0	200.0				263.0	157.0		15.0	200.0					200.0	
Soybean meal	70.0	83.0		85.0	85.0	107.0	38.0	152.0	207.0		240.0	240.0	240.0	139.0	139.0	
Sunflower meal	147.0	200.0	202.0	122.0	122.0		200.0		42.0	197.0	30.0	30.0	30.0	106.0		
Rapeseed meal							52.0		50.0	60.0				80.0		
Heat treated full fat soybean		33.0	110.6	100.0	100.0				94.0		82.0			17.5	100.0	
Rapeseed seed	50.0	60.0				87.4	28.0									
High fat meat meal (55% Nx6.25)				31.0	31.0						54.0	54.0	54.0	36.0		
Soybean protein isolate																
Rapeseed oil	20.0	50.0	30.0	39.0	39.0	56.0	50.0	49.0	46.0	20.0	44.0	44.0	44.0	45.0	40.0	
Sucrose		4.0		35.0		1.1	13.0		30.0						44.0	
Lactose					44.0											
Cellulose	26.6	50.0		9.0						20.0						
L-Lysine	0.4		1.4													
DL-Methionine											0.4	0.4	0.4		0.6	
Threonine																
Tryptophane																
Isoleucine																
Valine																
Calcium carbonate	17.0	16.4	18.0	16.0	16.0	14.0	17.0	16.5	17.0	17.0	12.3	12.3	12.3	13.2	17.0	
Dicalcium Phosphate	19.0	18.6	16.0	11.0	11.0	16.5	17.3	20.5	18.0	17.0	10.3	10.3	10.3	11.8	18.0	
Sodium chloride	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Mineral supplement ¹	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Vitamin supplement ²	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Calculated (as fed basis)																
AMEn (adult cockerel) (MJ/kg)	11.29	11.16	11.86	12.55	12.55	13.39	11.52	13.18	12.24	10.48	13.03	13.03	13.03	11.89	13.12	
Nx6.25	153	191	160	181	181	165	174	179	184	190	203	203	203	200	186	
Lysine	7.0	10.0	7.3	8.3	8.3	9.5	8.2	9.0	9.4	9.3	10.4	10.4	10.4	9.6	10.6	
Methionine+cystine	6.0	6.9	6.2	6.3	6.3	5.7	6.8	6.4	6.7	7.1	7.1	7.1	7.1	7.4	6.5	
Threonine	5.5	7.2	5.5	6.3	6.3	6.4	6.5	6.8	7.0	7.0	7.5	7.5	7.5	7.5	7.0	
Tryptophane	1.8	2.3	1.8	2.1	2.1	1.8	2.1	2.0	2.3	2.2	2.1	2.1	2.1	2.3	2.0	
Leucine	11.6	13.4	11.8	13.2	13.2	13.0	10.7	13.9	12.6	11.4	17.6	17.6	17.6	12.7	15.3	
Isoleucine	6.8	8.7	6.8	7.8	7.8	7.4	6.9	7.2	7.5	7.4	8.9	8.9	8.9	7.5	8.3	
Valine	7.9	9.7	7.9	8.9	8.9	8.2	8.0	8.0	8.3	8.3	10.2	10.2	10.2	8.6	9.0	
Calcium	12.0	12.0	11.8	12.1	12.1	10.1	12.0	12.1	11.9	12.0	12.0	12.0	12.0	12.0	11.5	
Available phosphorus	4.6	4.5	4.1	4.0	4.0	4.0	4.5	4.5	4.4	4.5	4.0	4.0	4.0	4.5	4.0	
Sodium	1.87	1.82	1.87	2.05	2.05	1.78	1.90	1.77	1.87	1.89	2.03	2.03	2.03	2.13	1.69	
Potassium	6.24	8.16	6.40	7.02	7.02	7.31	7.20	7.55	7.84	8.02	7.57	7.57	7.57	7.60	8.28	
Chloride	3.00	3.00	3.01	3.13	3.13	2.85	3.01	2.90	2.97	2.98	3.23	3.23	3.23	3.21	2.82	

¹Supplies (mg/kg diet): Co from CoCO₃, 0.33 ; Cu from CuSO₄, 8.7; I from KI, 1.2; Se from Na₂SeO₃, 0.2; Zn from ZnO, 84; Fe from FeSO₄, 44; Mn from MnO, 106.

²Supplies (mg/kg diet): vitamin A (all-trans-retinol), 3; cholecalciferol, 0.04; vitamin E (d1-alpha-tocopheryl acetate), 15; butylated hydroxy toluene, 125; menadione, 5; thiamine, 0.5; riboflavin, 4; calcium pantothenate, 8; niacin, 25; pyridoxine, 1; vitamin B₁₂, 0.008; folic acid, 1; biotin, 0.4; choline chloride, 750.

Table S1b. Composition (g/kg) of experimental diets (diet numbers from 14 to 28).

Diet N°	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Trial N°	1	2	1	2	1	1	2	3	2	3	3	3	2	3	1	
Ingredients																
Maize	299.0	345.0	278.0	585.0	355.0	177.7	410.0	522.0	479.0	387.0	479.0		186.0	282.5	219.0	
Wheat	200.0	30.0	252.0		191.0	195.0						440.0	255.0	250.0	250.0	
Peas		220.0	27.0		63.0		250.0			249.0		150.0	275.0			
Soybean meal	62.0	180.0	255.0	229.0	210.0	155.0	112.0	114.0	157.0	86.0	130.0	11.4	87.0	230.0	84.0	
Sunflower meal	169.0					250.0		61.0	120.0		150.0	214.0		52.0	179.0	
Rapeseed meal						60.0								20.0		
Heat treated full fat soybean	120.0	85.0					120.0	100.0		100.0					80.0	
Rapeseed seed			60.0	60.0	70.0				98.0			100.0	87.0	50.0		
High fat meat meal (55% Nx6.25)	70.0	21.0	50.0	60.0	60.0	60.0	36.0	70.0	70.0	70.0	70.0			50.0	50.0	
Soybean protein isolate			10.0	22.4	27.0	6.0		60.0	56.0	46.0	81.0				54.0	
Rapeseed oil	53.0	45.0	36.0	18.8		58.0	35.0	51.0		39.0		35.0	59.0	37.0	59.0	
Sucrose		10.0					4.5					6.0	2.8			
Lactose		28.0														
Cellulose						10.0										
L-Lysine	0.2												2.1			
DL-Methionine	0.3	1.0	0.4	0.2	0.5		1.0	0.6		1.2			2.8	0.1	0.1	
Threonine													1.3			
Tryptophane													0.3			
Isoleucine													0.6			
Valine													0.8			
Calcium carbonate	11.0	10.5	13.3	6.4	7.1	9.5	9.4	5.2	4.5	6.3	4.6	19.0	14.0	10.0	7.6	
Dicalcium Phosphate	5.5	14.5	8.3	9.2	7.4	8.8	12.1	7.2	6.5	6.5	6.4	14.6	16.4	8.4	8.3	
Sodium chloride	4.0	4.0	4.0	3.0	3.0	4.0	4.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	
Mineral supplement ¹	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Vitamin supplement ²	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Calculated (as fed basis)																
AMEn (adult cockerel) (MJ/kg)	12.82	13.06	12.88	13.01	12.27	11.34	13.04	13.76	12.14	13.34	11.95	11.70	13.40	12.55	12.86	
Nx6.25	208	210	220	222	231	238	210	247	257	247	270	162	165	214	240	
Lysine	9.7	12.2	12.0	11.8	12.6	11.4	12.0	12.9	13.4	14.3	14.0	7.4	10.8	11.1	11.8	
Methionine+cystine	7.4	7.4	7.7	7.7	8.2	8.7	7.4	8.8	9.1	8.7	9.6	6.5	8.2	7.5	8.5	
Threonine	7.3	7.9	8.2	8.3	8.6	8.8	7.8	8.9	9.6	9.0	9.9	6.0	7.3	8.0	8.5	
Tryptophane	2.2	2.2	2.5	2.4	2.5	2.7	2.1	2.6	2.8	2.5	3.0	1.9	1.9	2.4	2.8	
Leucine	15.5	16.8	17.4	19.2	18.5	15.8	16.8	20.3	21.0	19.4	23.1	11.1	12.4	16.3	18.0	
Isoleucine	8.7	9.4	9.8	9.9	10.3	9.6	9.0	11.0	11.7	10.8	12.5	7.2	7.5	9.2	10.9	
Valine	10.1	10.1	11.0	11.2	11.5	11.1	9.9	12.1	13.1	11.7	13.8	8.4	8.5	10.4	12.0	
Calcium	12.0	9.9	11.9	10.1	10.0	12.0	10.0	10.0	9.9	10.1	9.9	12.0	10.0	10.8	10.0	
Available phosphorus	4.0	4.0	3.9	4.0	4.0	4.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Sodium	2.24	1.81	2.16	1.80	1.90	2.26	1.91	2.04	2.06	1.96	2.18	1.91	1.78	2.13	2.00	
Potassium	7.27	8.99	8.18	7.43	7.81	8.39	7.32	7.00	7.29	7.98	6.98	6.60	7.01	8.09	7.23	
Chloride	3.35	2.94	3.23	2.70	2.72	3.41	3.01	2.82	2.90	2.70	2.98	3.01	2.84	3.25	2.80	

¹Supplies (mg/kg diet): Co from CoCO₃, 0.33 ; Cu from CuSO₄, 8.7; I from KI, 1.2; Se from Na₂SeO₃, 0.2; Zn from ZnO, 84; Fe from FeSO₄, 44; Mn from MnO, 106.

²Supplies (mg/kg diet): vitamin A (all-trans-retinol), 3; cholecalciferol, 0.04; vitamin E (d1-alpha-tocopheryl acetate), 15; butylated hydroxy toluene, 125; menadione, 5; thiamine, 0.5; riboflavin, 4; calcium pantothenate, 8; niacin, 25; pyridoxine, 1; vitamin B₁₂, 0.008; folic acid, 1; biotin, 0.4; choline chloride, 750.

Table S2a. Analyses of diets and *in-vivo* measurements¹ (excreta pool from 8 birds) of digestibilities and AMEn value of diets in 4 week broilers (diet numbers from 1 to 13).

Diet number	1	2	3	4	5	6	7	8	9	10	11.1	11.2	11.3	12	13	
Trial number	1	3	2	2	2	2	3	3	3	1	1	2	3	1	1	
Chemical and physical analyses of diets (dry matter basis)																
Gross energy (MJ/kg)	18.82	19.57	19.11	19.28	19.22	19.98	19.23	19.54	18.92	18.59	19.40	19.42	19.52	19.30	19.17	
N x 6.25 (g/kg)	184	219	180	205	203	193	196	208	207	214	229	226	228	229	205	
Lipids A (no treatment before extraction) (g/kg)	63	104	77	86	85	122	88	110	76	56	87	87	88	79	87	
Lipids B (acidic treatment before extraction) (g/kg)	73	109	83	89	90	125	90	113	83	60	94	94	97	88	94	
Non-Cell-Wall carbohydrates ² (g/kg)	479	354	482	458	474	490	441	472	493	428	480	478	477	431	513	
Starch P (Polarimetric method) (g/kg)	412	300	434	368	376	442	364	416	404	366	433	439	447	380	401	
Starch E (DMSO-Enzyme method) (g/kg)	423	280	434	366	368	422	368	407	396	365	429	420	448	362	371	
Total sugars (reducing sugar method) (g/kg)	41	59	41	81	83	47	64	51	88	54	45	43	46	48	98	
Sucrose and glucose (g/kg)	21	29	20	60	24	24	38	30	61	25	26	25	27	27	72	
Fermentable sugars (α -galactosides and lactose) (g/kg)	14	29	12	17	60	21	22	18	19	21	15	15	15	15	25	
Crude fibre (g/kg)	86	116	69	57	57	37	85	34	40	96	34	33	31	57	36	
NDF ³ (g/kg)	168	202	160	147	137	107	175	102	114	187	109	110	108	149	96	
WICW ³ (g/kg)	190	237	186	177	161	130	202	134	147	223	124	132	128	177	118	
Ash (g/kg)	74	81	69	72	71	63	72	74	70	76	73	70	70	76	69	
Undetermined ⁴ (g/kg)	21	16	16	16	22	22	12	16	17	17	11	18	-13	27	45	
RAV ⁵ (mL/g)	1.76	1.53	1.95	1.99	1.86	1.51	1.81	1.09	1.72	2.07	0.62	0.70	0.80	1.89	0.96	
PAV ⁵ (mL/g)	2.08	1.86	2.31	2.37	2.34	1.60	2.14	1.70	2.14	2.25	0.81	0.81	0.87	2.26	1.01	
Cell-wall retained water (g water / g diet)	1.33	1.65	1.48	1.50	1.31	1.29	1.73	1.19	1.36	1.78	0.87	1.06	1.10	1.43	1.01	
Measured <i>in-vivo</i> apparent digestibilities																
Protein (%)	80.9	82.5	83.1	81.5	78.6	84.2	81.6	83.7	81.7	82.7	84.5	85.3	84.2	80.9	87.1	
Lipids B (%)	71.8	77.2	76.5	75.1	80.0	86.8	75.2	84.9	79.7	83.7	89.1	85.7	84.7	80.6	90.6	
Starch (DMSO-Enzyme) (%)	95.2	93.8	96.0	95.3	92.7	94.0	93.9	95.6	95.0	95.2	97.7	97.2	97.7	96.3	96.6	
Fermentable sugars (%)	93.9	92.3	89.4	94.3	81.0	86.8	94.2	91.3	85.3	88.6	86.6	83.5	86.2	92.1	88.7	
AMEn values (dry matter basis)																
Direct equation (MJ/kg) for adult cockerel ⁶	12.78	12.91	13.42	13.43	13.61	15.25	13.02	14.70	13.96	12.19	14.57	14.62	14.91	13.52	14.37	
Indirect equation 1 (MJ/kg) for adult cockerel ⁶	12.83	12.21	13.22	13.43	13.72	15.17	12.87	14.58	13.73	11.67	14.52	14.40	14.56	13.29	14.58	
Indirect equation 2 (MJ/kg) for adult cockerel ⁶	12.74	12.50	13.17	13.48	13.76	15.26	13.04	14.70	13.89	11.95	14.45	14.36	14.48	13.25	14.63	
Measured <i>in vivo</i> values (MJ/kg) in 4 w broilers	11.89	11.85	12.55	12.68	12.44	14.51	12.02	14.05	12.97	11.44	14.33	14.23	14.30	12.95	14.35	

¹Three day balance experiment with total collection of excreta

² Non-Cell-Wall carbohydrates=1000 - Nx6.25 - Lip.B - WICW - Ash

³NDF=Neutral Detergent Fiber (with amylase: Van Soest *et al.*, 1991); WICW = Water-Insoluble Cell-Wall (Carré and Brillouet, 1989).

⁴Undetermined = 1000 - Nx6.25 - Lip.B - St.E - Sucr. - Glc - Ferm.Sug. - WICW - Ash

⁵RAV=Real Applied Viscosity; PAV=Potential Applied Viscosity (Carré *et al.*, 1994).

⁶Direct: 0.0155 Nx6.25 + 0.0343 Lip.B + 0.0167 St.P + 0.0130 Sug.Re. (Fisher and McNab, 1987); Indirect 1: 0.9362 Gr.En. - 0.00644 Nx6.25 - 0.00665 WICW^{1,2} (Carré and Brillouet, 1989); Indirect 2: 16.68 + 0.0197 Lip.A - 0.0222 Ash - 0.0187 WICW (Carré and Brillouet, 1989).

Table S2b. Analyses of diets and *in-vivo* measurements¹ (excreta pool from 8 birds) of digestibilities and AMEn value of diets in 4 week broilers (diet numbers from 14 to 28).

Diet number	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Trial number	1	2	1	2	1	1	2	3	2	3	3	3	2	3	1
Chemical and physical analyses of diets (dry matter basis)															
Gross energy (MJ/kg)	20.09	19.54	19.76	19.68	19.29	19.80	19.60	20.48	19.90	20.05	19.81	19.54	20.11	19.85	20.25
N x 6.25 (g/kg)	232	232	250	249	261	267	231	269	284	265	298	191	194	242	264
Lipids A (no treatment before extraction) (g/kg)	113	95	102	89	69	92	95	117	83	99	71	96	123	95	107
Lipids B (acidic treatment before extraction) (g/kg)	123	99	108	98	77	100	101	123	89	105	79	103	127	104	117
Non-Cell-Wall carbohydrates ² (g/kg)	396	479	442	463	458	323	476	418	393	448	382	431	489	437	384
Starch P (Polarimetric method) (g/kg)	344	388	392	419	416	275	414	380	356	405	363	372	444	389	334
Starch E (DMSO-Enzyme method) (g/kg)	339	380	379	442	410	274	405	372	355	399	339	372	459	374	332
Total sugars (reducing sugar method) (g/kg)	45	91	52	45	54	55	50	34	41	43	37	52	49	54	47
Sucrose and glucose (g/kg)	24	37	29	26	26	29	30	23	26	22	23	28	24	30	24
Fermentable sugars (α -galactosides and lactose) (g/kg)	13	63	21	16	20	14	22	14	16	24	12	17	27	18	14
Crude fibre (g/kg)	72	31	35	25	33	102	33	37	52	35	62	89	37	43	69
NDF ³ (g/kg)	167	81	113	102	117	206	101	122	139	104	151	174	110	127	163
WICW ³ (g/kg)	176	125	127	126	136	230	128	127	166	117	173	205	129	146	166
Ash (g/kg)	73	65	74	65	68	80	65	63	69	65	67	70	61	71	69
Undetermined ⁴ (g/kg)	19	-2	13	-21	1	6	19	9	-4	4	7	14	-21	15	13
RAV ⁵ (mL/g)	1.36	0.97	1.29	0.79	1.35	1.52	1.02	0.60	0.66	0.58	0.63	1.69	1.32	1.41	1.37
PAV ⁵ (mL/g)	1.61	1.12	1.71	0.67	1.36	1.52	0.86	0.86	0.89	0.70	0.81	2.07	1.63	1.71	1.84
Cell-wall retained water (g water / g diet)	1.38	0.95	1.13	1.08	1.10	1.75	1.12	1.04	1.47	0.99	1.31	1.70	1.28	1.34	1.30
Measured <i>in-vivo</i> apparent digestibilities															
Protein (%)	81.4	83.8	80.5	84.7	84.2	81.9	86.0	84.4	84.4	84.7	86.5	83.0	85.7	81.5	82.0
Lipids B (%)	85.2	90.4	84.8	87.5	88.6	86.4	90.5	88.5	86.4	88.6	87.2	77.5	86.5	86.0	87.9
Starch (DMSO-Enzyme) (%)	96.8	95.6	95.8	97.6	97.3	96.4	95.8	97.1	97.2	95.6	97.6	93.6	96.0	95.2	96.5
Fermentable sugars (%)	93.3	88.6	93.9	85.7	84.8	91.7	82.3	94.9	92.3	95.4	80.8	83.4	85.9	88.3	95.2
AMEn values (dry matter basis)															
Direct equation (MJ/kg) for adult cockerel ⁶	14.14	14.66	14.79	14.80	14.34	12.88	14.59	15.18	13.93	15.04	13.88	13.37	15.42	14.52	14.28
Indirect equation 1 (MJ/kg) for adult cockerel ⁶	14.02	14.63	14.66	14.63	13.97	12.28	14.63	15.22	13.74	15.06	13.40	13.11	15.30	14.40	14.18
Indirect equation 2 (MJ/kg) for adult cockerel ⁶	13.99	14.78	14.67	14.65	13.98	12.43	14.73	15.22	13.68	15.00	13.35	13.18	15.34	14.25	14.14
Measured <i>in vivo</i> values (MJ/kg) in 4 w broilers	13.40	14.30	13.82	14.49	13.94	12.15	14.54	14.90	13.75	14.75	13.41	12.66	14.86	13.66	13.81

¹Three day balance experiment with total collection of excreta

²Non-Cell-Wall carbohydrates=1000 - Nx6.25 - Lip.B - WICW - Ash

³NDF=Neutral Detergent Fiber (with amylase: Van Soest *et al.*, 1991); WICW = Water-Insoluble Cell-Wall (Carré and Brillouet, 1989).

⁴Undetermined = 1000 - Nx6.25 - Lip.B - St.E - Sucr. - Glc - Ferm.Sug. - WICW - Ash

⁵RAV=Real Applied Viscosity; PAV=Potential Applied Viscosity (Carré *et al.*, 1994).

⁶Direct: 0.0155 Nx6.25 + 0.0343 Lip.B + 0.0167 St.P + 0.0130 Sug.Re. (Fisher and McNab, 1987); Indirect 1: 0.9362 Gr.En. - 0.00644 Nx6.25 - 0.00665 WICW^{1,2} (Carré and Brillouet, 1989); Indirect 2: 16.68 + 0.0197 Lip.A - 0.0222 Ash - 0.0187 WICW (Carré and Brillouet, 1989).

Table S3. Correlation¹ matrix (n=30) for dietary analytical data and contents of digestible components.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17
Gross energy (X1)	1.00																
N x 6.25 (X2)	0.55	1.00															
Lipids B ² (X3)	0.83	0.06	1.00														
Non-Cell-Wall carbohydrates ³ (X4)	-0.39	-0.58	-0.11	1.00													
Starch E ⁴ (X5)	-0.16	-0.37	-0.03	0.84	1.00												
Total sugars (reducing) ⁵ (X6)	-0.42	-0.34	-0.18	0.32	-0.17	1.00											
Sucrose and glucose (X7)	-0.35	-0.25	-0.15	0.30	-0.11	0.81	1.00										
Fermentable sugars ⁶ (X8)	-0.12	-0.18	0.02	0.25	-0.05	0.63	0.12	1.00									
WICW ⁷ (X9)	-0.31	-0.16	-0.32	-0.64	-0.65	-0.04	-0.11	-0.14	1.00								
Ash (X10)	-0.42	-0.10	-0.31	-0.48	-0.58	0.09	0.06	-0.14	0.69	1.00							
Undetermined ⁸ (X11)	-0.36	-0.34	-0.15	0.09	-0.32	0.32	0.37	-0.02	0.20	0.37	1.00						
RAV ⁹ (X12)	-0.53	-0.61	-0.29	-0.02	-0.20	0.31	0.15	0.08	0.64	0.45	0.37	1.00					
PAV ⁹ (X13)	-0.46	-0.60	-0.21	-0.04	-0.22	0.29	0.13	0.09	0.60	0.46	0.39	0.96	1.00				
Digestible proteins (X14)	0.55	0.99	0.06	-0.51	-0.29	-0.36	-0.23	-0.20	-0.22	-0.19	-0.36	-0.70	-0.69	1.00			
Digestible lipids (X15)	0.86	0.22	0.96	-0.07	0.02	-0.19	-0.16	0.04	-0.48	-0.42	-0.20	-0.47	-0.41	0.24	1.00		
Digestible starch (X16)	-0.12	-0.29	-0.03	0.81	0.99	-0.21	-0.12	-0.10	-0.67	-0.58	-0.35	-0.27	-0.29	-0.21	0.03	1.00	
Digestible fermentable sugars (X17)	-0.10	-0.17	0.04	0.22	-0.08	0.63	0.13	0.99	-0.13	-0.12	-0.02	0.08	0.09	-0.19	0.06	-0.13	1.00

¹Values are significant ($P < 0.05$) for $|r| \geq 0.362$

²Lipids with an acidic treatment before extraction

³Non-Cell-Wall carbohydrates (g/kg) = 1000 - Nx6.25 - Lip.B - WICW - Ash

⁴Starch from DMSO-Enzyme method

⁵Total sugars from reducing sugar method

⁶ α -galactosides and lactose

⁷WICW = Water-Insoluble Cell-Wall (Carré and Brillouet, 1989)

⁸Undetermined (g/kg) = 1000 - Nx6.25 - Lip.B - St.E - Sucr. - Glc - Ferm.Sug. - WICW - Ash

⁹RAV=Real Applied Viscosity; PAV=Potential Applied Viscosity (Carré *et al.*, 1994)

Table S4. Water excretion parameters, and dry matter excretion relative to feed intake (dry matter) (mean and pooled SE, n=8) in 4 week broilers.

Diet number	Trial number	Excreted water / feed intake DM (%)	Residual of [g excreted water / day = f (g feed intake DM / day)] (g)	Water content of excreta (%)	Dry matter excretion / feed intake DM (%)
1	1	103	-10	73.7	36.4
2	3	126	18	74.5	42.9
3	2	107	-7	75.0	34.8
4	2	118	9	76.7	35.2
5	2	127	23	77.2	36.8
6	2	85	1	72.6	30.7
7	3	140	34	77.9	38.3
8	3	99	-2	76.5	29.8
9	3	112	1	77.3	32.6
10	1	126	23	75.5	40.4
11.1	1	99	-5	77.5	28.6
11.2	2	90	-11	75.7	28.5
11.3	3	94	-2	76.2	29.1
12	1	114	7	76.2	34.5
13	1	103	4	79.1	26.9
14	1	117	13	76.9	34.9
15	2	103	-3	77.6	29.3
16	1	109	6	77.2	31.7
17	2	85	-21	75.0	28.2
18	1	87	-15	74.9	28.9
19	1	130	18	75.5	41.7
20	2	92	-14	76.3	28.2
21	3	81	-12	72.7	30.0
22	2	98	-5	74.4	33.4
23	3	83	-19	74.0	28.8
24	3	109	6	75.7	34.6
25	3	104	-7	73.9	36.5
26	2	85	-12	75.3	27.5
27	3	106	7	75.4	34.3
28	1	90	-17	72.6	33.6
s.e.		6.0	6.5	0.93	0.58
<i>P</i>		0.0001	0.0001	0.0001	0.0001

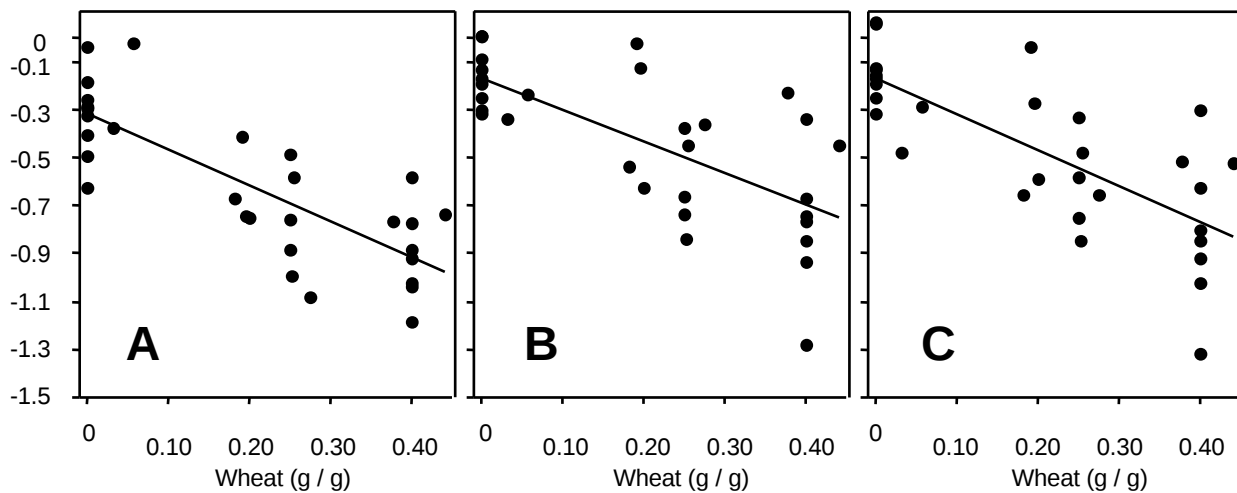
Table S5. Correlations¹ (n=30) between mean AMEn, mean digestibilities and dietary analytical data.

	AMEn	Starch digestibility	Lipid digestibility	Protein digestibility	Digestibility of fermentable sugars
AMEn	1.00				
Starch digestibility	0.51	1.00			
Lipid digestibility	0.78	0.56	1.00		
Protein digestibility	0.64	0.53	0.62	1.00	
Digestibility of fermentable sugars	-0.15	0.01	-0.21	-0.33	1.00
Gross energy	0.60	0.27	0.52	0.25	0.23
N x 6.25	0.33	0.59	0.59	0.24	0.10
Lipids A	0.52	-0.10	0.32	0.12	0.23
Lipids B	0.54	-0.03	0.35	0.12	0.23
Non-Cell Wall carbohydrates	0.38	-0.07	0.02	0.22	-0.35
Starch P	0.55	0.20	0.15	0.39	-0.39
Starch E	0.50	0.20	0.09	0.33	-0.34
Total sugars (reducing)	-0.17	-0.40	-0.09	-0.19	-0.11
Sucrose and glucose	-0.04	-0.11	-0.07	0.07	0.03
Fermentable sugars	0.01	-0.47	0.09	-0.18	-0.23
Crude Fibre	-0.87	-0.43	-0.60	-0.44	0.27
NDF	-0.85	-0.30	-0.59	-0.48	0.30
WICW	-0.91	-0.39	-0.64	-0.47	0.21
Ash	-0.74	-0.20	-0.46	-0.56	0.29
Undetermined	-0.34	-0.36	-0.23	-0.25	0.11
RAV	-0.77	-0.65	-0.73	-0.70	0.12
PAV	-0.75	-0.68	-0.77	-0.76	0.20

¹Values are significant ($P < 0.05$) for $|r| \geq 0.362$.

Figure S1. Differences (MJ / kg DM) between measured (4 week broilers) and predicted (adult cockerels) AMEn values of diets: relationships with wheat introduction (g/g).

Measured AMEn – predicted AMEn (MJ / kg DM)



A: Difference from direct equation : $y = -0.311 - 1.46 \text{ wheat}$ ($R^2 = 0.61$); B: Difference from indirect equation 1 : $y = -0.168 - 1.33 \text{ wheat}$ ($R^2 = 0.46$); C: Difference from indirect equation 2 : $y = -0.167 - 1.51 \text{ wheat}$ ($R^2 = 0.54$). See Tables S2 for significance of direct and indirect equations. Trial effects on residual values were not significant. One point represents the mean value for one diet.