

**EFFECT OF KLINOFEED SUPPLEMENTATION ON
PERFORMANCE OF BROILERS FED
LOW NUTRIENT DIETS**

Trial No. AB12263B

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Effect of Klinofeed[®] supplementation on performance of broilers fed low nutrient diets

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Objective

This trial was conducted to evaluate the effect of adding a HSCAS product (Klinofeed[®]) on performance of broilers fed low nutrient diet.

Materials and methods

Four hundred eighty newly hatched male broiler chicks (Arbor Acres Plus) were randomly allocated to 5 treatments with 6 replications using 16 chicks per pen as an experimental unit. A practical corn-soybean meal diet was used as the positive control diet (PC, normal ME, calcium and phosphorus). A low dietary energy (reduced ME 120 kcal/kg) diet was used as negative control 1 and a low dietary calcium and phosphorus diet (reduced 30% of normal Ca & P) was used as negative control 2 (NC 1 and NC 2). Aliquots of each negative control diet was supplemented with Klinofeed at 5 kg/t feed according to the treatment design below.

Table 1 Treatment design.

Treatment	Diet description	Nutrient spec (starter/grower)		
		ME (kcal/kg)	Ca (%)	P (%)
1	Positive control (PC)	3050/3150	1.00/0.90	0.50/0.40
2	Negative control 1 (NC 1)	2930/3030	1.00/0.90	0.50/0.40
3	Negative control 2 (NC 2)	3050/3150	0.70/0.60	0.35/0.30
4	NC1 + Klinofeed 5 kg/t	2930/3030	1.00/0.90	0.50/0.40
5	NC2 + Klinofeed 5 kg/t	3050/3150	0.70/0.60	0.35/0.30

All diets were supplemented with a phytase enzyme (BASF Natuphos). Feed samples were collected at the animal house (exposed to the air for 24 hours) and analyzed for mycotoxins (*Vicam, 1999 method*).

The composition and nutrient content of the experimental diets are shown in table 2 and 3. The experiment was conducted in a close-sided house with tunnel ventilation and evaporative cooling system. Birds were raised on solid-concrete-floor pens using rice hull as bedding material. Each pen measured 1.0 m x 1.5 m and was equipped with a self-feeder and three nipple water drinkers. Feed and water were provided *ad libitum*. All experimental diets were in pellet form. Sacox (salinomycin 12%) was used in feed at the level of 500 g/t to control coccidiosis. Lighting program was provided according to the Arbor Acres Plus broiler management manual. The average max/min temperature and relative humidity in the house were 36.7/31.7°C and 63.9% during 0-7 days of age, 32.5/28.6°C and 80.3% during 7-18 days of age and 30.8/27.4°C and 84.3% during 18-35 days of age, respectively. Total pen feed consumption was recorded weekly. Body weight and feed intake as pen basis were measured for growth calculation at the end of day 18 and 35 days. Mortality was recorded daily. At 35 days of age two birds per pen, which are closely to average body weight of each

pen, were selected and used for blood and tibia sample collection. Blood serum samples were analyzed for blood urea nitrogen (BUN) by the enzyme colorimetric method, blood calcium by Arsenazo reagent reaction and blood phosphorus by a chemical method involving the direct UV measurement of the phosphomolybdate complex. Tibia samples were defatted by petroleum extraction and analyzed ash by burn in the Muffle furnace at 600°C for 6 hours (AOAC 1981, p25). Feed intake, body weight gain, feed conversion, livability and carcass trait were determined and subjected to analysis of variance as a randomized complete block design.

Table 2 Composition and nutrient of starter diet.

CODE	INGREDIENTS	PRICE (Baht/kg)	STARTER (0-18 days)		
			PC (normal ME and Ca & P)	NC1 (low ME, normal Ca & P)	NC2 (normal ME, low Ca & P)
B120-2	Corn 7.5%	12.0	49.41	52.02	51.79
B426	Soybean Meal (DH) 49%	17.2	34.16	33.76	33.79
B417-2	Full Fat Soybean 36%	20.7	5.00	5.00	5.00
B402	Rapeseed Meal 37.5%	7.4	2.00	2.00	2.00
B202	Soybean Oil	48.0	4.46	2.24	3.68
B601-2	MCP 15.8/21.1	20.0	2.08	2.08	1.29
B602-2	Lime Stone 38.9% Ca	1.4	1.29	1.29	0.85
B603	Salt	4.0	0.37	0.37	0.37
B501	L-Lysine HCl	86.0	0.15	0.16	0.15
B502	DL-Methionine	150.0	0.27	0.27	0.27
B503	L-Threonine	92.0	0.03	0.03	0.03
B504	L-Tryptophan	1200.0			
B908	Pellet Binder	70.0	0.30	0.30	0.30
B703	Broiler Premix	165.0	0.20	0.20	0.20
B605	Sodium Bicarbonate	15.0	0.15	0.15	0.15
B606-1	Choline Chloride 50%	64.0	0.08	0.08	0.08
B903	Coccidiostat (salinomycin 12%)	185.0	0.05	0.05	0.05
TOTAL			100.00	100.00	100.00
FEED COST			16.84	16.03	16.53
CODE	Nutrients	UNIT			
1	Weight	Kg	1	1	1
2	Dry Matter	%	88.13	87.86	87.89
3	Me.For Poultry	Kcal/Kg	3,050	2,930	3,050
9	Crude Protein	%	23.3	23.4	23.4
11	Crude Fat	%	7.82	5.71	7.13
12	Linoleic Acid	%	3.85	2.80	3.50
13	Crude Fiber	%	3.32	3.36	3.36
17	Dig.Lys (Poultry)	%	1.24	1.24	1.24
18	Dig.Met (Poultry)	%	0.58	0.58	0.58
19	Dig.Cys (Poultry)	%	0.31	0.31	0.31
20	Dig.M+C (Poultry)	%	0.89	0.89	0.89
21	Dig.Thr (Poultry)	%	0.77	0.77	0.77
22	Dig.Trp (Poultry)	%	0.22	0.21	0.21
23	Dig.Arg (Poultry)	%	1.44	1.43	1.43
24	Dig.Val (Poultry)	%	0.96	0.96	0.96
25	Dig.Ile (Poultry)	%	0.81	0.81	0.81
26	Dig.Leu (Poultry)	%	1.64	1.65	1.65
46	Lysine	%	1.40	1.40	1.40
47	Arginine	%	1.59	1.58	1.58
48	Methionine	%	0.61	0.61	0.61
49	Met + Cys	%	1.00	1.00	1.00
50	Cystine	%	0.38	0.38	0.38
52	Threonine	%	0.91	0.91	0.91
53	Tryptophan	%	0.28	0.28	0.28
55	Histidine	%	0.60	0.60	0.60
56	Isoleucine	%	0.99	0.99	0.99
57	Leucine	%	1.82	1.83	1.83
58	Valine	%	1.09	1.09	1.09
59	Phenylalanin	%	1.00	1.00	1.00
66	Calcium	%	1.00	1.00	0.70
67	Phosphorus-Total	%	0.84	0.85	0.68
68	Phosphorus-Avail.	%	0.50	0.50	0.35
69	Non Phytate	%	0.58	0.58	0.41
78	Sodium	%	0.20	0.20	0.20

79	Chloride	%	0.26	0.26	0.26
80	Salt	%	0.41	0.41	0.41

Table 3 Composition and nutrient of grower diet.

CODE	INGREDIENTS	PRICE (Baht/kg)	GROWER (18-35 days)		
			PC (normal ME and Ca & P)	NC1 (low ME, normal Ca & P)	NC2 (normal ME, low Ca & P)
B120-2	Corn 7.5%	12.0	56.43	59.01	58.48
B426	Soybean Meal (DH) 49%	17.2	23.66	23.29	23.37
B417-2	Full Fat Soybean 36%	20.7	8.00	8.00	8.00
B402	Rapeseed Meal 37.5%	7.4	3.00	3.00	3.00
B202	Soybean Oil	48.0	4.68	2.46	4.00
B601-2	MCP 15.8/21.1	20.0	1.54	1.54	1.01
B602-2	Lime Stone 38.9% Ca	1.4	1.30	1.30	0.74
B603	Salt	4.0	0.32	0.32	0.32
B501	L-Lysine HCl	86.0	0.09	0.10	0.10
B502	DL-Methionine	150.0	0.19	0.19	0.19
B503	L-Threonine	92.0	-	-	-
B504	L-Tryptophan	1200.0	0.01	0.01	0.01
B908	Pellet Binder	70.0	0.30	0.30	0.30
B703	Broiler Premix	165.0	0.20	0.20	0.20
B605	Sodium Bicarbonate	15.0	0.15	0.15	0.15
B606-1	Choline Chloride 50%	64.0	0.08	0.08	0.08
B903	Cocciostat (salinomycin 12%)	185.0	0.05	0.05	0.05
TOTAL			100.00	100.00	100.00
FEED COST			16.49	15.68	16.25
CODE	Nutrients	UNIT			
1	Weight	Kg	1	1	1
2	Dry Matter	%	88.08	87.81	87.87
3	Me.For Poultry	Kcal/Kg	3,150	3,030	3,150
9	Crude Protein	%	20.1	20.1	20.1
11	Crude Fat	%	8.71	6.60	8.11
12	Linoleic Acid	%	4.26	3.21	3.96
13	Crude Fiber	%	3.24	3.28	3.27
17	Dig.Lys (Poultry)	%	1.00	1.00	1.00
18	Dig.Met (Poultry)	%	0.47	0.46	0.46
19	Dig.Cys (Poultry)	%	0.28	0.29	0.29
20	Dig.M+C (Poultry)	%	0.75	0.75	0.75
21	Dig.Thr (Poultry)	%	0.64	0.64	0.64
22	Dig.Trp (Poultry)	%	0.17	0.17	0.17
23	Dig.Arg (Poultry)	%	1.20	1.20	1.20
24	Dig.Val (Poultry)	%	0.82	0.82	0.82
25	Dig.Ile (Poultry)	%	0.69	0.69	0.69
26	Dig.Leu (Poultry)	%	1.45	1.45	1.45
46	Lysine	%	1.14	1.14	1.14
47	Arginine	%	1.33	1.33	1.33
48	Methionine	%	0.49	0.49	0.49
49	Met + Cys	%	0.84	0.84	0.84
50	Cystine	%	0.34	0.35	0.35
52	Threonine	%	0.76	0.76	0.76
53	Tryptophan	%	0.24	0.24	0.24
55	Histidine	%	0.51	0.51	0.51
56	Isoleucine	%	0.83	0.83	0.83
57	Leucine	%	1.60	1.61	1.61
58	Valine	%	0.94	0.94	0.94
59	Phenylalanin	%	0.85	0.85	0.85
66	Calcium	%	0.90	0.90	0.60
67	Phosphorus-Total	%	0.71	0.72	0.60
68	Phosphorus-Avail.	%	0.40	0.40	0.30
69	Non Phytate	%	0.46	0.46	0.35
78	Sodium	%	0.18	0.18	0.18
79	Chloride	%	0.23	0.23	0.23
80	Salt	%	0.36	0.36	0.36

Results

Table 4 Effect of Klinofeed supplementation on performance of broilers¹ fed low nutrient diets (0-18 days of age).

Treatment			Initial	Final	Body	Feed	Feed	Feed	Livability
Group	Diet	Klinofeed	body	weight	weight	intake	conversion	conversion	
		(kg/MT)	weight	gain	gain	(g)	ratio ²	ratio ³	(%)
			(g)	(g)	(g)				
1	Positive control	-	41	886 ^a	845 ^a	1002 ^{bc}	1.186 ^a	1.186 ^a	100.0
2	Negative control 1	-	41	869 ^b	828 ^{bc}	1019 ^{ab}	1.230 ^{cd}	1.230 ^{bc}	100.0
3	Negative control 2	-	41	854 ^c	813 ^c	986 ^c	1.212 ^b	1.214 ^b	99.0
4	Negative control 1	5.0	41	875 ^{ab}	834 ^{ab}	1030 ^a	1.236 ^d	1.236 ^c	100.0
5	Negative control 2	5.0	41	865 ^{bc}	824 ^{bc}	1007 ^b	1.221 ^{bc}	1.234 ^{bc}	99.0
<i>P-value</i>				0.0036	0.0036	0.0013	0.0001	0.0002	0.5919
<i>Pooled SEM</i>				5.022	4.979	6.563	0.003	0.007	0.670
<i>C.V.%</i>				1.41	1.47	1.59	0.68	1.39	1.65

^{a,b,c} Means within column with no common superscript differ significantly ($p < 0.05$).

¹ Male broilers (Arbor Acres Plus).

² Feed conversion ratio corrected for mortality and culls.

³ Feed conversion ratio uncorrected for mortality and culls.

Table 5 Effect of Klinofeed supplementation on performance of broilers¹ fed low nutrient diets (19-35 days of age).

Treatment			Initial	Final	Body	Feed	Feed	Feed	Livability	
Group	Diet	Klinofeed	body	weight	weight	intake	conversion	conversion		
		(kg/MT)	weight	gain	gain	(g)	ratio ²	ratio ³	(%)	
			(g)	(g)	(g)					
1	Positive control	-	886 ^a	2721	1835	2909	1.587 ^a	1.591 ^a	99.0	
2	Negative control 1	-	869 ^b	2661	1792	2918	1.629 ^b	1.629 ^b	100.0	
3	Negative control 2	-	854 ^c	2663	1808	2878	1.592 ^a	1.589 ^a	99.0	
4	Negative control 1	5.0	875 ^{ab}	2675	1800	2926	1.626 ^b	1.627 ^b	99.0	
5	Negative control 2	5.0	865 ^{bc}	2668	1802	2871	1.593 ^a	1.602 ^{ab}	98.9	
<i>P-value</i>				0.0036	0.1702	0.3887	0.3590	0.0027	0.0210	0.9046
<i>Pooled SEM</i>				5.022	18.644	15.767	22.498	0.008	0.010	0.941
<i>C.V.%</i>				1.41	1.71	2.14	1.90	1.28	1.54	2.32

^{a,b,c} Means within column with no common superscript differ significantly ($p < 0.05$).

¹ Male broilers (Arbor Acres Plus).

² Feed conversion ratio corrected for mortality and culls.

³ Feed conversion ratio uncorrected for mortality and culls.

Table 6 Effect of Klinofeed supplementation on performance of broilers¹ fed low nutrient diets (0-35 days of age).

Treatment			Initial body weight (g)	Final weight gain (g)	Body weight gain (g)	Feed intake (g)	Feed conversion ratio ²	Feed conversion ratio ³	Livability (%)
Group	Diet	Klinofeed (kg/MT)							
1	Positive control	-	41	2721	2680	3909	1.459 ^a	1.467 ^a	99.0
2	Negative control 1	-	41	2661	2620	3936	1.503 ^c	1.503 ^{bc}	100.0
3	Negative control 2	-	41	2663	2622	3860	1.473 ^{ab}	1.477 ^{ab}	97.9
4	Negative control 1	5.0	41	2675	2634	3954	1.501 ^c	1.507 ^c	99.0
5	Negative control 2	5.0	41	2668	2627	3874	1.475 ^b	1.491 ^{abc}	97.9
<i>P-value</i>				0.1702	0.1654	0.0663	0.0001	0.0464	0.7676
<i>Pooled SEM</i>				18.644	18.594	24.636	0.005	0.010	1.287
<i>C.V.%</i>				1.71	1.73	1.54	0.84	1.64	3.19

^{a,b,c} Means within column with no common superscript differ significantly ($p < 0.05$).

¹ Male broilers (Arbor Acres Plus).

² Feed conversion ratio corrected for mortality and culls.

³ Feed conversion ratio uncorrected for mortality and culls.

Table 7 Effect of Klinofeed supplementation on blood components and tibia ash of broilers¹ fed low nutrient diets (at 35 days of age).

Treatment			Blood urea (mg/dL)	Blood calcium (mg/dL)	Blood phosphorus (mg/dL)	Tibia Ash (%)
Group	Diet	Klinofeed (kg/MT)				
1	Positive control	-	2.91	10.38	6.14	51.27 ^{ab}
2	Negative control 1	-	3.88	10.35	6.08	52.43 ^a
3	Negative control 2	-	4.03	10.22	6.18	50.56 ^b
4	Negative control 1	5.0	4.11	10.31	6.23	52.21 ^a
5	Negative control 2	5.0	3.99	10.29	6.19	50.46 ^b
<i>P-value</i>			0.5162	0.8910	0.9337	0.0164
<i>Pooled SEM</i>			0.541	0.121	0.120	0.455
<i>C.V.%</i>			35.01	2.87	4.75	2.17

¹ Male broilers (Arbor Acres Plus).

Table 8 Effect of Klinofeed supplementation on mycotoxin in experimental diet.

Group	Treatment		Aflatoxin ¹	Aflatoxin ¹	Aflatoxin ¹	Aflatoxin ¹	Total ¹	Ochratoxin ¹
	Diet	Klinofeed (kg/MT)	G1 (ug/kg)	G2 (ug/kg)	B1 (ug/kg)	B2 (ug/kg)	aflatoxin (ug/kg)	(ug/kg)
Starter (0-18 days)								
1	Positive control	-	N ²	N ²	1.04	N ²	1.04	N ²
2	Negative control 1	-	N ²	N ²	1.09	N ²	1.09	N ²
3	Negative control 2	-	N ²	N ²	1.11	N ²	1.11	N ²
4	Negative control 1	5.0	N ²	N ²	1.26	N ²	1.26	N ²
5	Negative control 2	5.0	N ²	N ²	1.01	N ²	1.01	N ²
Grower (18-35 days)								
1	Positive control	-	N ²	N ²	1.24	N ²	1.24	N ²
2	Negative control 1	-	N ²	N ²	1.08	N ²	1.08	N ²
3	Negative control 2	-	N ²	N ²	1.20	N ²	1.20	N ²
4	Negative control 1	5.0	N ²	N ²	1.20	N ²	1.20	N ²
5	Negative control 2	5.0	N ²	N ²	1.40	N ²	1.40	N ²

¹ = Analysis method as Vicam (1999)

² = Not detected

APPENDIX I

(Data)