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Effect of Different Levels of Bentonite with Varying Energy Levels on the Performance of Broilers

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ABSTRACT

Two hundred and forty day old broiler chicks were used to investigate the effect of adding 0, 2.5, 3.5 and 4.5% of Sodium Bentonite along with two levels of metabolizable energy 3000 and 2800 Kcal/ kg on weight gain, feed consumption, feed efficiency, economics of production and dressing percentage. During starter phase, there was significant ($P< 0.05$) effect of four Bentonite and two energy levels on weight gain. The interaction between Bentonite and energy levels was found non- significant; the feed consumption values were also found non- significant. In case of feed efficiency, the significant results came with respect to metabolizable energy levels only. During finisher phase all the parameters remained statistically similar. It was found that high-energy rations gave better turnover than low energy rations with Bentonite.

Key Words: Bentonite; Broiler performance; Feed additive; Energy

INTRODUCTION

In poultry industry different feed additives and growth promoters have been used to decrease cost of production. Bentonite, a feed additive, have been used successfully without any harmful effect (Southern *et al.,* 1994). Bentonite is composed of 75% or more of clay minerals and is a complex material with SiO_2 53.788%, Al_2O_3 22.378%, Fe_2O_3 3.90%, CaO 1.65%, MgO 2.123% Na_2O 1.96%, K_2O 0.693% and organic matter 13.43% (Butt *et al.,* 1984). The exact mode of action is yet un-known, however, it is hypothesized that due to high swelling nature of Bentonite, it decreases the flow rate of digesta thus allowing greater absorption of digested nutrients in the intestines (Artamonova, *et al.,* 1989). So less feed will be required to achieve a required gain in weight, which will increase profit margin.

This study was conducted a) to investigate the interaction of different levels of Bentonite with varying levels of energy on weight gain, feed intake and feed efficiency of broilers; and b) to find out the economic feasibility of inclusion of Bentonite in broiler rations.

MATERIALS AND METHODS

Two hundred forty day-old Hubbard broiler chicks were used for this study. They were wing banded for identification and were individually weighed on weekly intervals. They were then randomly divided into 24 experimental units of 10 chicks each. The experiment was conducted in two phases i.e. starter phase (0 – 4 weeks) and finisher phase (5 – 6 weeks). During the starter phase eight iso-nitrogenous experimental broiler starter rations having about 23% crude protein (CP) with two levels (3000 and 2800 kcal/kg) of metabolizable energy (ME) supplemented with four levels of Bentonite i.e. 0, 2.5, 3.5 and 4.5% were formulated. The approximate ME values for rations A, B, C, and D; and E, F, G, and H were 3000 and 2800 Kcal/kg, respectively (Table I & II).

Table I. Percent composition of broiler starter rations

Ingradients	Rations							
	A	B	C	D	E	F	G	H
Maize	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Wheat	32.6	28.0	26.0	25.0	34.0	29.6	28.6	27.1
RP	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
CSM	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
RM	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
GM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MG	1.0	2.0	2.4	2.4	0.6	2.0	2.0	2.0
FiM	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
BM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
FM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SM	2.0	3.1	3.7	3.7	0.0	0.5	0.5	1.0
CM	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
DCP	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
LG	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
VMP	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SB	0.0	2.5	3.5	4.5	0.0	2.5	3.5	4.5
Total	100	100	100	100	100	100	100	100

RP= Rice polishing; CSM= Cotton seed meal; RM= Rapeseed meal; GM= Guar meal; MG= Maize gluten 60%; FiM= Fish meal; BM= Blood meal; FM= Feather meal; SM= Soybean meal; CM= Cane molasses; LG= Limestone ground; VMP= Vitamin mineral premix; SB= Sodium Bentonite

Table II. Nutrient composition of broiler starter rations

Nutr.	Rations							
	A	B	C	D	E	F	G	H
CP	23.04	23.08	23.08	23.0	23.0	23.30	23.18	23.0
ME	3016	3002	3005	3049	2867	2822	2800	2864
CF	4.50	4.40	4.35	4.32	4.54	4.44	4.41	4.37
Ca	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P	0.38	0.37	0.37	0.37	0.38	0.38	0.37	0.37

Nutr.= Nutrients; CP= Crude protein (%); ME= Metabolizable energy (Kcal/kg); Crude fibre (%); Ca= Calcium (%); P= P available (%)

Each level of Bentonite was added in two rations varying in their ME content *viz-a-viz* 0% in ration A and E, 2.5% in B and F, 3.5% in C and G, and 4.5% in D and H.

Likewise, after four weeks, eight iso-nitrogenous broiler finisher rations having 19% CP with the same other parameters (Energy and Bentonite levels) were formulated. These rations were designated as A', B', C', D', E', F', G' and H' (Table III & IV).

Table III. Percent composition of broiler finisher rations

Ingradients	Rations							
	A'	B'	C'	D'	E'	F'	G'	H'
Maize	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Wheat	39.3	36.0	34.3	32.1	41.0	38.1	36.8	35.5
RP	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
CSM	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
RM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MG	0.0	1.0	1.2	1.7	0.0	0.4	0.7	1.0
FiM	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
BM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
FM	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
SM	1.75	1.5	2.0	2.7	0.0	0.0	0.0	0.0
CM	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
DCP	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LG	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
VMP	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SB	0.0	2.5	3.5	4.5	0.0	2.5	3.5	4.5
Total	100	100	100	100	100	100	100	100

RP= Rice polishing; CSM= Cotton seed meal; RM= Rapeseed meal; GM= Guar meal; MG= Maize gluten 60%; FiM= Fish meal; BM= Blood meal; FM= Feather meal; SM= Soybean meal; CM= Cane molasses; LG= Limestone ground; VMP= Vitamin mineral premix; SB= Sodium Bentonite

Table IV. Nutrient composition of broiler finisher rations

Nutr.	Rations							
	A'	B'	C'	D'	E'	F'	G'	H'
CP	19.12	19.11	19.02	19.06	19.12	19.00	19.03	19.05
ME	3013	3008	3001	3004	2886	2811	2854	2822
CF	4.32	4.20	4.16	4.11	4.32	4.25	2.22	4.60
Ca	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.59
P	0.38	0.38	0.38	0.37	0.38	0.38	0.38	0.38

Nutr.= Nutrients; CP= Crude protein (%); ME= Metabolizable energy (Kcal/kg); Crude fibre (%); Ca= Calcium (%); P= P available (%)

All the formulation was done according to NRC (1994). Weekly feed consumption and weight gain of each experimental unit was recorded. At the end of starter phase, all the eight groups of birds (three replicates each) were changed over to eight corresponding experimental broiler finisher rations in the same manner. At the end of the experimental period, two birds from each experimental unit (replicate) were randomly selected for dressing percentage. All the experimental rations were analyzed for dry matter (DM), crude protein (CP) and crude fibre (CF) by proximate analysis (AOAC, 1984). The comparative data calculated for weight gain, feed consumption, feed efficiency and dressing percentage were analyzed using analysis of variance technique. The means were differentiated by Duncon's Multiple Range Test (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Weight gain. It is evident from Table V that birds fed on starter rations having higher energy level gained more weight compared with those on rations having low energy level. Moreover, the interaction between the Bentonite and energy levels was found non-significant (Table VI). However, there was no difference in weight gain of chicks on two levels of ME and four levels of Bentonite during finisher phase (Table VI). The interaction between Bentonite and energy was also found to be non-significant (Table VIII). Sellers *et al*. (1980), and Petkova and Ivonov (1982) have reported that weight gain in chicks given low energy diets is not affected by Bentonite.

Feed consumption. There was non-significant difference in feed consumption amongst the birds with the various combinations of Bentonite and energy. Similarly, Bentonite and energy interaction was revealed non-significant difference (Table V). The non-significant trend with respect to feed consumption in the experimental period is in complete agreement with that of Sellers *et al*. (1980), and Petkova and Ivonov (1982).

Table V. Average weight gain, feed consumption and feed efficiency of broilers fed on starter rations

Metabolizable energy levels	3000 Kcal /kg				2800 Kcal /kg			
Bentonite	**0**	**2.5%**	**3.5%**	**4.5%**	**0**	**2.5%**	**3.5%**	**4.5%**
Rations	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Weight gain (g)	982.983	935.633	915.517	892.200	871.300	880.950	888.517	820.750
Feed consumption (g)	1436.270	1583.870	1511.800	1502.970	1619.100	1570.300	1561.070	1698.130
Feed efficiency	1.457	1.697	1.653	1.683	1.827	1.780	1.760	1.993

Table VI. Average weight gain, feed consumption and feed efficiency on different levels of Bentonite and Energy (0 – 4 weeks)

Description	Bentonite levels				Energy levels	
	0	**2.5%**	**3.5%**	**4.5%**	**3000 kcal/kg**	**2800 kcal/kg**
Weight gain (g)	927.142a	908.292ab	902.017ab	856.475 b	931.583 a	865.379 b
Feed consumption (g)	1527.68	1577.08	1536.43	1600.55	1508.73	1612.15
Feed efficiency	1.642	1.738	1.707	1.838	1.623 a	1.840 b

Table VII. Average weight gain, feed consumption and feed efficiency of broilers fed on finisher rations

Metabolizable energy levels	3000 Kcal /kg				2800 Kcal /kg			
Bentonite	**0**	**2.5%**	**3.5%**	**4.5%**	**0**	**2.5%**	**3.5%**	**4.5%**
Rations	**A'**	**B'**	**C'**	**D'**	**E'**	**F'**	**G'**	**H'**
Weight gain (g)	598.407	604.667	656.370	616.817	696.500	563.647	637.517	629.333
Feed consumption (g)	1553.940	1691.930	1658.070	1577.630	1612.530	1551.090	1657.090	1671.530
Feed efficiency	2.600	2.817	2.560	2.570	2.673	2.760	2.613	2.667
Dressing % age	73.533	74.483	73.977	73.330	74.740	74.010	73.663	71.297

Table VIII. Average weight gain, feed consumption and feed efficiency on different levels of Bentonite and Energy (0 – 6 weeks)

Description	Bentonite levels				Energy levels	
	0	**2.5%**	**3.5%**	**4.5%**	**3000 kcal/kg**	**2800 kcal/kg**
Weight gain (g)	597.453	581.157	646.942	622.075	618.565	606.748
Feed consumption (g)	1587.240	1621.510	1657.590	1624.580	1620.400	1623.060
Feed efficiency	2.637	2.788	2.587	2.618	2.637	2.678
Dressing %age	74.137	74.247	73.820	72.313	73.831	73.427

Table IX. Economics of different experimental rations

Description	Experimental rations							
Rations	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Bentonite levels (%)	**0**	**2.5**	**3.5**	**4.5**	**0**	**2.5**	**3.5**	**4.5**
Average live weight per broiler (kg)	1.581	1.531	1.572	1.563	1.483	1.495	1.526	1.483
Feed consumption per broiler (kg)	3.156	3.276	3.170	3.081	3.214	3.095	3.218	3.369
Feed cost per kg of ration (Rs.)	6.952	7.651	7.932	8.196	6.539	6.992	7.176	7.361
Feed cost per broiler (Rs.)	21.940	25.060	25.140	25.250	21.060	21.640	23.090	24.800
Cost of day old chick (Rs.)	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
Total cost per chick (Rs.)	31.940	35.060	35.140	35.250	31.020	31.640	33.090	34.800
Marketing value per live broiler (Rs.)	44.270	42.870	44.020	43.760	41.520	40.460	42.730	41.520
Gross profit (Rs.)	12.330	7.804	8.872	8.513	10.510	8.820	9.636	6.725

Results of present study differ from that of Blair *et al*. (1986) and Hebert *et al*. (1986) who reported the use of low levels of Bentonite i.e. 0.33-0.99% of the diet affect the birds in both way to increase weight gain and feed consumption. The addition of Bentonite (2.5%) improved feed consumption when compared to the higher level of Bentonite (> 2.5%), indicating that the higher levels of Bentonite might have deleterious effect on the performance of birds (Table V & VII). It may be suggested that due to highly adhesive nature of the Bentonite when it absorbs moisture resist the flow of digesta through GIT, which affecting the feed intake negatively (Van Olphen, 1963).

Feed efficiency. Feed efficiency values were found to be significant ($P<0.05$) with respect to energy levels only, however non-significant differences were observed due to Bentonite levels (Table V). Similarly, the interaction between Bentonite and energy levels revealed non-significant differences. During finisher phase, there was non-significant difference among different rations due to Bentonite and energy levels for feed efficiency (Table VII). Whereas, non-significant differences between two energy levels for feed efficiency were observed. Similarly, Bentonite and energy interaction was also non-significant.The non significant results with respect to feed efficiency are in compete agreement with that of Sellers *et al.* (1980), Petkova and Ivonov (1982), Eslmeralda and Gonzales (1991) and Southern *et al.* (1994). The use of Bentonite with low energy rations failed to show any improvement in the feed efficiency. The weekly performance of the chicks revealed better results during early growth period i.e. from 0–4 weeks, which shows a relationship with nutrient component of the feed as the requirements for these differ at early and late life stage of broiler chicks. It is concluded that Bentonite at 1% level has certainly positive effect on the growth performance of broiler chicks due to one or the other reason.

Dressing percentage. There was no statistical difference in dressing percentage of birds among different rations. Similarly, the interaction between Bentonite and energy levels with respect to dressing percentage also found non-significantly different (Table VIII).

Economics. The least cost ration was "E" (Rs. 6.539 per kg) and costly one was "D" (Rs. 8.196 per kg). The highest profit came out of ration "A" (Rs. 12.328 per kg) while least profit came out of ration "H" (Rs. 6.725 per kg). This indicate that inclusion of Bentonite to rations costs more than rations with out Bentonite and on the other hand high

energy rations gave better turnover than low energy rations with Bentonite (Table IX).

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