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Interaction of floor space, dietary energy level and feed enzyme influencing growth performance of growing turkey

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ABSTRACT

A biological experiment was conducted (2×3×2 factorial design) involving 2 floor spaces (1.25 and 1.90 sq. ft), 3 dietary energy levels (2400, 2600 and 2800 ME kcal/kg) with or without supplementation of commercial multi-enzyme (@ 250g/ton feed) in iso-proteinic diet (protein, 20%) to evaluate growth performance in 'White turkey' (CARI Virat) during 8–16 weeks of age. The levels of critical amino acids (lysine and methionine) remained similar in all the diets.Straight-run 120 poults were randomly distributed into twelve experimental groups with four replicate in experimental battery cages (1.64 ft × 2.30 ft) at two different floor spaces (1.25 and 1.90 ft^2/bird) from 8^{th} to 16^{th} week of age. The total number of birds per cage were 2 and 3 respectively. Out of 4 replicates, 1 replicate was maintained for the replacement of the dead birds, if any, so as to keep the effective floor space constant throughout the experimental period. Results indicated that body weight, body weight gain, feed intake and feed conversion ratio did not differ significantly due to floor space or enzyme supplementation. Performance index was significantly higher in 1.25 sq. ft. floor space. Overall body weight gain did not differ significantly due to energy levels. Feed intake and feed: gain ratio was significantly lower in group having 2,800 kcal/kg. Performance index was significantly higher in groups fed with 2,600 and 2,800 kcal/kg. Final body weight and cumulative feed intake differed significantly due to interaction between space and energy. Feed enzyme supplementation did not improve performance.Thus the optimum floor space in battery cages for rearing growing turkey poults (8–16 wk) and dietary energy level were 1.25 sq. ft/bird and 2,600 kcal ME per kg diet, respectively.

Key words: Energy, Feed enzyme, Floor space, Growing turkey, Growth performance

Diversification is the need of the day especially for rural poultry farming. Turkey is an important poultry species reared for meat production. It is one of the favoured white meat famous for its leanness and delicacy. Turkey poults grow very rapidly and for the best performance they should never be over crowded. Day by day there is decreasing availability of land and increasing demand of poultry meat and egg; so intensification is needed to increase the number of birds per unit of space, to reduce housing, equipment and labor costs. Energy needs are dynamic and change continuously during the growth of an animal. Accurate and precise data describing the energy requirements of poultry are needed to formulate more efficient and less costly diets. The increase in the cost of feed ingredients has led to interest in the use of enzymes in poultry diets. The non-starch polysaccharides present in cell walls of plant origin feedstuffs can reduce nutrient utilization, growth rate and efficiency of feed utilization. There may be problem of wet litter due to increased viscosity of gut lumen contents as well as physical barrier to endogenous enzymes. It is possible to improve feed utilization in various ways. One possibility is the use of enzymes for production of feeds from various conventional and unconventional substances. In fact, there has been hardly any systematic research on turkey management in tropical countries like India. So the present study was carried out to evaluate the interaction of floor space, energy level and feed enzyme supplementation in diet on growth performance.

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MATERIALS AND METHODS

In order to study the interaction of floor space, energy level and mixed (cocktail) feed enzyme supplementation in turkey diets on growth performance; a biological experiment of 8 weeks duration was undertaken in winter (January to March) employing 2 different floor spaces (1.25 and 1.90 ft^2/bird), 3 dietary energy levels (2,400, 2,600 and 2,800 kcal ME/kg) with or without supplementation of commercial multi-enzyme (cocktail) @ 250g/tonnes in diet with similar dietary CP (20%) amino acids and minerals more or less similar as suggested by NRC (1994) following 2 × 3 × 2 factorial design (Table 1). Straight-run 8 wk old

Table 1. The ingredient (%) and nutrient composition of test diets of growing turkey poults (8-16 wk)

Feed ingredients	Gross composition (kg/100kg)		
	D1	D2	D3
Maize, yellow	52.81	40.58	28.52
Rice bran (solv. ext.)	8.8	23.3	37.6
Soybean meal (solv. ext.))	35.8	33.7	31.6
Limestone powder	0.72	1	1.25
Di-calcium phosphate	1.20	0.75	0.35
Common salt	0.3	0.3	0.3
L-Lysine hydrochloride	0.01	0.01	0.02
TM premix*	0.1	0.1	0.1
Vitamin premix*	0.15	0.15	0.15
B complex premix*	0.015	0.015	0.015
Choline chloride, 60%	0.05	0.05	0.05
Toxin binder	0.05	0.05	0.05
Total	100	100	100
Chemical composition (%)			
CP, %¶	20.00	20.00	20.00
ME kcal/kg ø	2801	2601	2403
Calcium, %¶	0.80	0.80	0.80
Available P, % ø	0.40	0.40	0.40
Lysine, %, % ø	1.20	1.20	1.20
Methionine, %	0.37	0.37	0.37
Threonine, % ø	0.88	0.79	0.71
Cost, ₹/kg ø	21.82	20.54	19.29
Cost with enzyme, ₹/kg	21.86	20.58	19.33
GE, kcal/kg**	4107.48	4066.47	4024.83
Fibre, %**	3.79	6.08	8.35

*Trace mineral premix supplied Mg 300, Mn 55, I 0.4, Fe 56, Zn 30 and Cu 4 mg/kg diet. The vitamin premix supplied vitamin A, 8,250 IU; vitamin D_3, 1200 ICU; vitamin K, 1 mg; vitamin E, 40 IU; vitamin B_1, 2 mg; vitamin B_2, 4 mg; vitamin B_{12}, 10 mcg; niacin, 60 mg; pantothenic acid, 10 mg; choline, 500 mg/kg diet. **, Analyzed values; ¶, Calculated based on analyzed ingredient values; ø, Calculated tabulated values.

(120) growing turkey birds CARI Virat of almost same body weight were randomly distributed into 12 experimental groups with 4 replicates in each group in experimental battery cages (1.64 ft × 2.30 ft) at 2 different floor space (1.25 and 1.90 ft^2/bird) from 8th to 16th week of age. The total number of birds per cage was 2 and 3, respectively.

The experimental birds were housed group wise in randomly allotted experimental cages with the provision of wire-mesh floor, feeder and waterer, located in well ventilated room, 24 h light and uniform management. Feeding and watering were *ad lib.* during 8–16 wk of age. Body weight changes were recorded periodically during the experimental period to ascertain the biweekly and overall body weight gain. Weighed quantity of respective diet was offered *ad lib.*daily to all groups of each dietary regimen in the morning and the residue was weighed at biweekly interval in order to arrive at biweekly and overall feed intake. Based on data pertaining to the feed intake and body weight gain, cumulative feed conversion ratio (feed: gain, FCR) and performance index (gain: FCR, PI) were calculated.

The data pertaining to various parameters were analyzed statistically by the methods of Snedecor and Cochran (1989). The mean differences were tested for significance as per Tukey test using SPSS software package (16.0).

RESULTS AND DISCUSSION

*Body weight (BW) and body weight gain (BWG):*In the present study, the mean body weight gain during 8–12, 12–16 or 8–16 weeks old, age did not differ significantly due to different floor spaces; however apparently higher overall gain was observed in 1.25 sq. ft than in 1.90 sq. ft (Table 2). It might be due to restricted movement of birds and hence they conserved more energy in lower space. The present observations were in agreement with the work reported earlier by Majumdar *et al.* (2003), who observed no difference in the 8-week body weight of poults at 3 floor densities i.e. 0.75, 1.0 and1.5 ft^2. Buijs *et al.* (2009) found that the final (39-d) BW was not significantly different between birds reared at different stocking densities (6, 15, 23, 33, 41, 47 and 56 kg/m^2). Houshmand *et al.* (2012) reported that broiler BW and BW gain were not affected by stocking density during the different periods of the experiment. In contrast to present findings, Davidson and Leighton (1984) indicated that higher population density caused lower body weight gain in turkey birds than it did at relatively low population density. Dozier *et al.* (2005, 2006), Bhanja *et al.* (2006), Al-Homidan and Robertson (2007), Seker *et al.*(2009), Nahashon *et al.* (2011) also reported that birds provided higher floor space recorded significantly higher BW and BWG. According to Ali *et al*. (2013) significantly ($P<0.01$) higher body weight gain (BWG) of poults was observed in 1.0 sq. ft floor space during 0–4 and 4–10 weeks of age.

Significantly higher body weight gain during 8–12 weeks was observed in 2,600 and 2,800 kcal/kg energy level than in 2,400 kcal/kg (Table 2). However, during 12–16 weeks of age there was no difference in weight gain in 2,400 or 2,600 kcal/kg diet, while lower gain was observed at 2,800 kcal/kg diet. During, overall growth phase, no significant difference existed between energy levels but maximum gain was observed at 2,600 kcal ME/kg. On the other hand, Saleh *et al*. (2004) reported significantly improved body weights by increasing dietary energy (MDE) levels. Similarly, Majumdar *et al*. (2002) also reported higher body weight in 8-week poults receiving diet with 26% CP and 2,800 kcal/ kg. BWG was significantly higher in 2,600 and 2,800 kcal/kg than in 2400 kcal/kg during 8–12 weeks of age. These observations are in agreement with Bartov (1992), Leeson *et al*. (1996a, 1996b), Nguyen *et al.* (2010) who reported that if essential dietary nutrients are maintained in relationship to dietary energy, an increased growth rate was observed with increasing levels of dietary energy. However, the results indicated that poults require lower energy (2,400 to 2,600 kcal/kg) beyond 12 weeks of age.

The mean body weight gain did not differ significantly due to enzyme supplementation in diet, although apparently higher gain was observed in enzyme supplemented groups

Table 2.Effect of floor space, energy levels and feed enzyme supplementation on overall bodyweight gain of growing turkeys

Interaction (space × energy × enzyme)			Overall body weight gain.(g/b)		
Space (sq ft)	ME (kcal /kg)	Enzyme	8-12 wk	12-16 wk	8-16 wk
1.25	2400	+	735	883	1619
1.25	2400	-	752	886	1637
1.25	2600	+	985	964	1950
1.25	2600	-	995	858	1853
1.25	2800	+	1063	774	1837
1.25	2800	-	959	694	1653
1.90	2400	+	825	849	1675
1.90	2400	-	907	933	1840
1.90	2600	+	955	856	1810
1.90	2600	-	865	793	1658
1.90	2800	+	996	679	1676
1.90	2800	-	1001	692	1693
Pooled SEM	17.40	21.22	31.85		
Space (sq ft)					
1.25	915	843	1758		
1.90	925	800	1725		
ME (kcal/kg)					
2400	793[p]	887[q]	1680		
2600	958[q]	877[q]	1835		
2800	1006[q]	715[p]	1721		
Enzyme					
+	927	842	1769		
-	911	810	1721		
Significance					
Space (sq ft)			NS	NS	NS
ME (kcal/kg)			P<0.01	P<0.01	NS
Enzyme			NS	NS	NS
Space * Energy			P<0.05	NS	NS
Space * Enzyme			NS	NS	NS
Energy * Enzyme			NS	NS	NS
Interaction			NS	NS	NS

(Table 2). The present observations are in agreement with the work reported by Satisha *et al.* (2011) who reported that supplementation of enzyme did not influence the body weight gain significantly until the age of 3rd week. Earlier works (Hong *et al*. 2002 and Gracia *et al*. 2003) indicated that enzyme supplementation improved the growth of birds significantly in different types of diet.

The mean body weight gain during 8–12 weeks of age (P<0.05) differed significantly due to interaction between space and energy. The interaction values were 744[a], 990[b], 1011[b], 866[ab], 910[b] and 999[b] g/b in 1.25 sq. ft and 2,400 kcal/kg, 1.25 sq. ft and 2,600 kcal/kg, 1.25 sq. ft and 2,800 kcal/kg, 1.90 sq. ft and 2,400 kcal/kg, 1.90 sq. ft and 2,600 kcal/kg and 1.90 sq. ft and 2,800 kcal/kg, respectively. Maximum gain was observed in 1.25 sq. ft and 2,800 kcal ME/kg feed; however the value was similar to all other combinations except for 1.25 sq. ft and 2,400 kcal/kg diet.

Feed intake (FI): Feed intake (FI) did not differ significantly due to floor spaces; however apparently higher FI was observed in 1.9 sq. ft than in 1.25 sq. ft during 8–12 wk of age (Table 3). However, Majumdar *et al.*(2003) reported that poults reared at lower floor spaces recorded significantly (P<0.01) lower feed intake than the poults at higher floor space during pre-starter and starter period. Similarly other workers (Puron *et al.* 1995 and Seker *et al.* 2009) also reported increase in feed consumption on increase in floor space.

The FI (g/b) of growing poults differed (P<0.01) due to energy level during 8–12, 12–16 or 8–16 weeks of age. Feed intake decreased linearly during 8–12 weeks of age while it was lower in 2,800 kcal/kg than in 2,400 or 2,600 kcal/kg during 12–16 weeks or 8–16 weeks of age. It might be due to the fact that the birds tend to eat to meet their energy needs, provided that the diet is adequate in essential nutrients.The present observations are in agreement with the work reported earlier by Saleh *et al*. (2004), who reported that feed intake tended to decrease with increasing nutrient density, but not at a rate commensurate with the change in energy levels. In contrast to our findings, Nguyen *et al.* (2010) reported that energy levels did not show

Table 3.Effect of floor space, energy levels and feed enzyme supplementation on cumulative feed consumption of growing turkeys

Interaction (space × energy × enzyme)			Overall feed consumption		
Space (sq ft)	ME (kcal /kg)	Enzyme	8-12	12-16	8-16
1.25	2400	+	2745	4154	6899
1.25	2400	-	2772	4124	6896
1.25	2600	+	3004	4291	7295
1.25	2600	-	3073	4313	7385
1.25	2800	+	2946	3796	6743
1.25	2800	-	2597	3291	5888
1.90	2400	+	3204	4528	7732
1.90	2400	-	3327	4683	8010
1.90	2600	+	2899	3982	6881
1.90	2600	-	2752	3764	6516
1.90	2800	+	2708	3369	6077
1.90	2800	-	2730	3336	6066
Pooled SEM	48.16	83.26	123.56		
Space (sq ft)					
1.25	2856	3995	6851		
1.90	2937	3944	6880		
ME (kcal/kg)					
2400	3012^{q}	4372^{q}	7384^{q}		
2600	2932^{pq}	4087^{q}	7019^{q}		
2800	2745^{p}	3448^{p}	6193^{p}		
Enzyme					
+	2918	4020	6938		
-	2875	3918	6793		
Significance					
Space (sq ft)			NS	NS	NS
ME (kcal/kg)			P<0.05	P<0.01	P<0.01
Enzyme			NS	NS	NS
Space × Energy			P<0.01	P<0.01	P<0.01
Space × Enzyme			NS	NS	NS
Energy × Enzyme			NS	NS	NS
Interaction			NS	NS	NS

abc (interaction); mn (floor space); pqr (energy levels); xy (enzyme): values bearing different superscripts within a column differ significantly (P<0.05), NS-Non significant.

significant effect on feed intake and CP intake but increasing dietary energy content leads to increased energy intake (P<0.01).

The FI did not differ significantly due to enzyme supplementation in diet; however the values were apparently higher in enzyme supplemented groups. The present observations are in agreement with the work reported earlier by Satisha *et al.* (2011), who observed that supplementation of enzyme did not influence the feed consumption significantly at 1st week of age. In contrast to our findings, Pettersson and Aman (1989) observed that there were significant effects on cumulative feed intake due to enzyme supplementation up to days 15 and 27, and during the period from 15 to 27 d (P<0.01). Gracia *et al*. (2003) reported that α-amylase supplementation of corn-SBM diets increased feed intake (FI) through 42 d.

The mean cumulative FC (g/b) differed significantly (P<0.01) due to interaction between space and energy during all the growth phases. The interaction values during 8–12 weeks of age were 2759^{a}, 3038^{ab}, 2772^{a}, 3266^{b}, 2825^{a} and 2719^{a} g/b in 1.25 sq. ft and 2,400 kcal/kg, 1.25 sq. ft and 2,600 kcal/kg, 1.25 sq. ft and 2,800 kcal/kg, 1.90 sq. ft and 2,400 kcal/kg, 1.90 sq. ft and 2,600 kcal/kg and 1.90 sq. ft and 2,800 kcal/kg, respectively fat, 12–16 weeks of age were $4,139^{bcd}$, $4,302^{cd}$, $3,543^{ab}$, $4,605^{d}$, $3,873^{abc}$ and $3,352^{a}$ g/b in 1.25 sq. ft and 2,400 kcal/kg, 1.25 sq. ft and 2,600 kcal/kg, 1.25 sq. ft and 2,800 kcal/kg, 1.90 sq. ft and 2,400 kcal/kg, 1.90 sq. ft and 2,600 kcal/kg and 1.90 sq. ft and 2,800 kcal/kg, respectively.

At 8–16 weeks of age, the values were $6,898^{ab}$, $7,340^{bc}$, $6,315^{a}$, 7871^{c}, $6,698^{ab}$ and $6,071^{a}$ g/b in 1.25 sq. ft and 2,400 kcal/kg, 1.25 sq. ft and 2,600 kcal/kg, 1.25 sq. ft and 2,800 kcal/kg, 1.90 sq. ft and 2,400 kcal/kg, 1.90 sq. ft and 2,600 kcal/kg and 1.90 sq. ft and 2,800 kcal/kg, respectively.

Feed conversion ratio (FCR): The overall feed conversion ratio (FCR) did not differ significantly due to

Table 4. Effect of floor space, energy levels and feed enzyme supplementation on cumulative feed conversion ratio (FCR) of growing turkeys

Interaction (space × energy × enzyme)			Overall FCR		
Space (sq ft)	ME (kcal /kg)	Enzyme	8-12 wk	12-16 wk	8-16 wk
1.25	2400	+	3.73	4.76	4.28
1.25	2400	-	3.72	4.68	4.24
1.25	2600	+	3.05	4.46	3.74
1.25	2600	-	3.09	5.18	4.02
1.25	2800	+	2.77	4.99	3.69
1.25	2800	-	2.71	4.76	3.56
1.90	2400	+	3.93	5.36	4.64
1.90	2400	-	3.68	5.13	4.39
1.90	2600	+	3.04	4.68	3.80
1.90	2600	-	3.18	4.77	3.93
1.90	2800	+	2.72	4.97	3.63
1.90	2800	-	2.74	4.84	3.59
Pooled SEM	0.07	0.07	0.06		
Space (sq ft)					
1.25	3.18	4.81	3.92		
1.90	3.21	4.96	3.99		
ME (kcal/kg)					
2400	3.76^{r}	4.99	4.38^{r}		
2600	3.09^{q}	4.77	3.87^{q}		
2800	2.73^{p}	4.89	3.62^{p}		
Enzyme					
+	3.21	4.87	3.96		
-	3.18	4.89	3.95		
Significance					
Space (sq ft)			NS	NS	NS
ME (kcal/kg)			P<0.01	NS	P<0.01
Enzyme			NS	NS	NS
Space × Energy			NS	NS	NS
Space × Enzyme			NS	NS	NS
Energy × Enzyme			NS	NS	NS
Interaction			NS	NS	NS

abc (interaction); mn (floor space); pqr (energy levels); xy (enzyme): values bearing different superscripts within a column differ significantly (P<0.05), NS-Non significant.

floor space; however apparently lower in 1.25 sq. ft (3.92) than in 1.90 sq. ft (3.99) in growing turkey poults (Table 4). The present observations are in agreement with the work reported by earlier workers (Ahuja *et al.* 1992, Al-Homidan and Robertson 2007, Houshmand *et al.* 2012) who reported no significant difference in feed conversion ratio due to stock density of poultry species. In contrast to our findings, Davidson and Leighton (1984) indicated that high population density caused lower feed efficiency than did a relatively low population density.

The FCR differed significantly due to dietary energy concentration during 8–12 and 8–16 weeks of age and during these phases, FCR improved linearly with increase in dietary energy level from 2,400 to 2,800 kcal/kg. The present observations were in agreement with the earlier workers (Bartov 1992, Leeson *et al*.1996a, 1996b), who reported that if essential dietary nutrients are maintained in relationship to dietary energy, an improved feed efficiency was observed with increasing levels of dietary energy.

The overall FCR did not differ significantly due to enzyme supplementation in diet. The present observations were in agreement with the work reported earlier by Hasting (1946) who reported that fungal enzyme supplements had no effect when added to low fibre diets. Rexen (1981) observed that enzyme mixture (consisting of cellulase, pectinase and protease) supplementation to diet containing better quality of barley did not improve the performance in chicks. In contrast to our findings, Jensan *et al*. (1957) noticed a significant feed efficiency response to an enzyme preparation in chicks fed diets containing barley. Pettersson and Aman (1989) observed that there were significant effects on FCR due to enzyme supplementation at both 15 and 27 d of age (P<0.01). According to Edney *et al.* (1989) feed conversion efficiency of chicks (0–3 weeks) was

Table 5.Effect of floor space, energy level and feed enzyme supplementation on performance index of growing turkeys

Interaction (space × energy × enzyme)			Performance index		
Space (sq ft)	ME (kcal /kg)	Enzyme	8-12 wk	12-16 wk	8-16 wk
1.25	2400	+	592.85	568.49	1142.86
1.25	2400	-	614.64	572.26	1170.03
1.25	2600	+	970.51	652.41	1564.31
1.25	2600	-	967.96	522.42	1401.57
1.25	2800	+	1150.81	482.13	1506.95
1.25	2800	-	1067.71	440.55	1393.64
1.90	2400	+	430.22	320.17	728.26
1.90	2400	-	495.42	376.99	849.15
1.90	2600	+	631.56	371.30	953.11
1.90	2600	-	545.00	336.43	843.98
1.90	2800	+	733.42	274.31	924.69
1.90	2800	-	735.44	287.99	946.43
Pooled SEM	35.46	22.96	46.25		
Space (sq ft)					
1.25	894.08^{n}	539.71^{n}	1363.22^{n}		
1.90	595.18^{m}	327.87^{m}	874.27^{m}		
ME (kcal /kg)					
2400	533.28^{p}	459.48^{q}	972.57^{p}		
2600	778.76^{q}	470.64^{q}	1190.74^{q}		
2800	921.84^{r}	371.25^{p}	1192.93^{q}		
Enzyme					
+	751.56	444.80	1136.70		
-	737.70	422.77	1100.80		
Significance					
Space (sq ft)			P<0.01	P<0.01	P<0.01
ME (kcal /kg)			P<0.01	P<0.05	P<0.01
Enzyme			NS	NS	NS
Space × Energy			P<0.01	NS	NS
Space × Enzyme			NS	NS	NS
Energy × Enzyme			NS	NS	NS
Interaction			NS	NS	NS

abc (interaction); mn (floor space); pqr (energy levels); xy (enzyme), values bearing different superscripts within a column differ significantly (P<0.05), NS-Non significant.

improved significantly with enzyme supplementation for diets containing hulled or hulless barley or oat groats. The differences in result might be due to the cereal or other feedstuffs used in the diets. Generally, feedstuffs rich in soluble non-starch polysaccharides respond to enzymes (Mandal *et al*. 2005), while the enzymes were not effective in conventional maize-soya based diets (Elangovan *et al*. 2004).

Performance index (PI): Performance index of growing turkey differed significantly due to floor space. PI was significantly higher in 1.25 sq. ft than in 1.90 sq. ft (Table 5). The present observations were in agreement with the work reported earlier by Majumdar *et al.* (2003) who reported that the poults reared at lower floor spaces (<1.0 Sq. ft) gave significantly better (P<0.05) performance index during pre-starter period. According to Ali (2013), performance index was significantly lower in 0.6 sq. ft floor space than 0.8 sq. ft or 1.0 sq. ft. In contrast to our findings, Agrawal *et al.* (2003) reported that there were no differences (P>0.05) in the performance index at third week of age in broiler quails when reared at different floor spaces. However, PI at 5–wk of age was significantly better for the birds reared at higher floor space.

There was no significant difference on overall (8–16 wk) PI in 2,600 kcal/kg (1,190.74) and 2800 kcal/kg (1,192.93) but significantly lower in 2,400 kcal/kg (972.57) (Table 5). PI did not differ significantly due to enzyme supplementation. However PI was apparently higher in enzyme supplemented diet groups (Table 5). PI differed significantly due to interaction between space and energy at $8–12^{th}$ (P<0.01) wk of age. The values during $8–12^{th}$ wk of age were 603.74^{ab}, 969.24^{c}, 1109.26^{c}, 462.82^{a}, 588.28^{a} and 734.43^{b} g/b in 1.25 sq. ft and 2400 kcal/kg, 1.25 sq. ft and 2600 kcal/kg, 1.25 sq. ft and 2800 kcal/kg, 1.90 sq. ft and 2400 kcal/kg, 1.90 sq. ft and 2600 kcal/kg and 1.90 sq. ft and 2800 kcal/kg, respectively. Based on the results, it is concluded that the optimum floor space in battery cages was 1.25 sq. ft/bird and dietary energy level was 2600 ME kcal/kg for rearing growing turkey poults during 8–16 weeks of age. Feed enzyme supplementation did not improve the performance of the birds.

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