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The effect of using different energy sources on growth and some carcass characteristics in Cobb 500 broiler chicks

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Abstract

The objective of the current study was to evaluate the effect of using different energy sources on performance and some carcass characteristics in Cobb 500 broiler chicks. A total of 600 one day-old Cobb 500 broiler chick with an average weight of 39 ± 0.50 g was randomly allocated into five treatments. Further each treatment was divided into four replicates. The chicks were fed a basal diet based on corn and energy level by Cobb 500 instruction manual as a control group, basal diet with 3% lesser energy than the control (E1), basal diet with 6% lesser energy than the control (E2), basal diet based on corn and fat level according to Cobb 500 instruction manual (E3), basal diet based on corn and fat with 3% upper energy (E4) for 42 days. The result of this study showed that there were significant differences between treatments compared to the control group. The feed conversion ratio of broiler chicks significantly increased ($P \leq 0.01$) by feeding E1, E2, E3 and E4. It was observed that the performance parameters showed little but significant differences ($P \leq 0.01$) throughout the experimental period. The result of this study showed that carcass, breast, liver, spleen and gizzard percentage increased by using treatments compared to the control. We concluded that the current nutritional recommendations in Cobb 500 broiler chicks' instruction manual are not sufficient to achieve the best growth performance of Cobb 500 broiler chicks.

Keywords: Energy sources; performance; carcass characteristics; Cobb 500 broiler

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Introduction

Poultry meat products are one of the important components of the human's diet in developed countries, and it is affected by various sensory properties such as colour, tenderness, and flavour (Resurreccion, 2002). These changes have driven the poultry industry to put an emphasis on the improvement of breast meat yield and muscle mass development (Abdullah et al., 2010). Energy and protein are very important nutrients for broilers like other living creatures. Energy is required for body functioning and protein is an essential constituent of all tissues of the animal body. Protein is having major effect on growth performance of the bird is the most expensive nutrient in broiler diets (Kamran et al., 2004). Poultry nutritionists have paid more

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attention to the use of animal protein sources to create a balanced diet (Akhter et al., 2008). Fats or oils are as energy rich feeds. Fats also provide varying quantities of the essential nutrient such as linoleic acid (Leeson, 2001). Another important role of fats in the diet is its inhibition from de novo lipogenesis in broiler chickens (Poorghasemi et al., 2013) that could increase energy efficiency in diets. Maiorka et al. (2004) showed that feed intake was not significantly influenced by the way amino acid requirements were expressed. They also noted that feed intake was not influenced by dietary energy level. Nobre et al. (1994) evaluated four energy levels and reported no significant differences in carcass yield between treatments. One of the major challenges for researchers is the provision of alternative feeds for monogastric animals. Corn has remained the major energy source in compounded diets for poultry. The various uses to which corn is being committed, such staple food for man, brewing and confectionary, has placed additional cost constraints on its continued use in poultry diets. The solution is to explore the use of alternative feed ingredients, hitherto under exploited by poultry farmers (Durunna et al., 2015). Among the alternative feedstuff such as corn and soybean which could be used as energy sources for poultry diet, even though it is lower in protein and other essential nutrients (Odukwe, 1994). Energy and protein are very important nutrients for broilers like other living creatures. Brake (1990) reported that the addition of 5% of poultry fat into the broiler breeder diets, egg production improved and feed intake reduced. Due to the effects of different sources of fat and protein levels on performance, growth and breast meat mass on poultries the current study was conducted to determine the effect of using different energy sources on performance and some carcass characteristics in Cobb 500 broiler chicks.

Materials and Methods

Birds and diets

This experiment was approved by the Department of Science and Research Branch, Islamic Azad University, Tehran, Iran. A total of 600 one day-old Cobb 500 broiler chick with an average weight of 39 ± 0.50 g were randomly allocated into five dietary treatments with four replicates each. This study was carried out in the poultry farm of Atomic Energy Organization, Karaj, Iran, for a period of 42 days. Chicks were fed a basal diet as control group, basal diet with 3% lesser energy than the control (E1), basal diet with 6% lesser energy than the control (E2), basal diet based on corn and fat level according to Cobb 500 instruction manual (E3), basal diet based on corn and fat with 3% upper energy (E4) as shown in Table 1. The experimental diets formulated by using (Cobb 500 performance and nutrition supplement instruction manual, 2013, and were provided *ad libitum.* The temperature was set at 36°C at day first and then eventually dropped to 18°C. Chickens were vaccinated according to routine vaccination program. During this experiment, feed and fresh water were provided *ad libitum*. The live body weight gain of bird was measured individually and feed consumption and feed conversion efficiency were measured.

Data collection

The body weight gains (BW), feed intake (FI), feed conversion ratio (FCR) and feed efficiency ratio (FER) of birds were measured daily. At 42 days old, for evaluation of carcass traits, all birds were processed after 4 h feed withdrawal and then two birds per treatment were randomly selected and killed in a commercial slaughter house according to the international bird's rights.

Statistical analysis

Data analysis was performed by using the general linear model procedure and the comparison of means

Table 1: Composition (%) of the experimental diets for broiler chicks (0-14 days old)

Ingredients	Control	E1	E2	E3	E4
Corn	61.25	60	58.62	56.10	54.17
Soybean meal	23.57	31.22	32.21	32.10	32.21
Corn gluten	10.52	4	4.38	4.56	4.74
Soybean oil	0	0	0	2.46	4.14
Dicalcium phosphate	2.03	2.03	2.05	2.04	2.05
Oyster shell	1.07	1.03	1.02	1.02	1.01
Common salt	0.16	0.20	0.23	0.23	0.20
L-Methionine	0.19	0.21	0.19	0.19	0.19
L- Lysine	0.30	0.34	0.36	0.36	0.36
L-Threonine	0.47	0.33	0.30	0.30	0.29
Mineral and Vitamin premix	0.07	0.14	0.14	0.14	0.14
Total	100	100	100	100	100
Calculated nutrient content					
ME (kcal/kg)	3035	2943	2853	3035	3120
CP (%)	22	22	22	22	22
Ca (%)	0.90	0.90	0.90	0.90	0.90
P (%)	0.45	0.45	0.45	0.45	0.45
Met (%)	0.65	0.67	0.67	0.67	0.67
Lys (%)	1.18	1.18	1.18	1.18	1.18
Met + Ces (%)	0.98	0.98	0.98	0.98	0.98
Thr (%)	0.86	0.86	0.84	0.86	0.86
Trp (%)	0.18	0.20	0.20	0.21	0.21
Arg (%)	1.24	1.24	1.24	1.24	1.24
Val (%)	0.91	0.91	0.91	0.91	0.91
Na (%)	0.17	0.17	0.17	0.17	0.17
K (%)	0.70	0.80	0.82	0.81	0.81
Cl (%)	0.23	0.23	0.23	0.23	0.23

E1: Basal diet with 3% lesser energy than control, E2: basal diet with 6% lesser energy than control, E3: basal diet based on corn and fat level according to Cobb 500 instruction manual, E4: basal diet based on corn and fat with 3% upper energy.

Table 2: Composition (%) of the experimental diets for broiler chicks (14-28 days old)

Ingredients	Control	E1	E2	E3	E4
Corn	69.22	67.7	68.8	65.31	59.31
Soybean meal	18	26.2	23.43	24	28.45
Corn gluten	8.2	0	3.24	4.2	2.9
Soybean oil	0	0	0	2	5
Dicalcium phosphate	1.9	1.9	1.9	1.9	1.9
Oyster shell	1.05	1.05	1.05	1.05	1.05
Common salt	0.37	0.37	0.37	0.37	0.37
L-Methionine	0.22	0.30	0.27	0.25	0.25
L- Lysine	0.44	0.28	0.34	0.32	0.22
L-Threonine	0.10	0.12	0.10	0.10	0.05
Mineral and vitamin premix	0.5	0.5	0.5	0.5	0.5
Filler	0	1.58	0	0	0
Total	100	100	100	100	100
Calculated nutrient content					
ME (kcal/kg)	3108	3014	2921	3108	3201
CP (%)	19	18.4	17.8	19	19.5
Ca (%)	0.84	0.84	0.84	0.84	0.84
P (%)	0.42	0.42	0.42	0.42	0.42
Met (%)	0.53	0.53	0.53	0.53	0.53
Lys (%)	1.05	1.05	1.05	1.05	1.05
Met + Ces (%)	0.89	0.89	0.89	0.89	0.89
Thr (%)	0.78	0.78	0.78	0.78	0.78
Trp (%)	0.21	0.22	0.22	0.22	0.22
Arg (%)	1.25	1.25	1.25	1.25	1.25
Val (%)	0.91	0.91	0.91	0.91	0.91
Na (%)	0.19	0.19	0.19	0.19	0.19
K (%)	0.72	0.81	0.85	0.81	0.86
Cl (%)	0.35	0.33	0.32	0.32	0.31

E1: Basal diet with 3% lesser energy than control, E2: basal diet with 6% lesser energy than control, E3: basal diet based on corn and fat level according to Cobb 500 instruction manual, E4: basal diet based on corn and fat with 3% upper energy.

was made through Duncan's (1995) multiple range tests by using SAS 9.1 software (SAS, 2004).

Results

Performance

The effect of the energy source on performance of Cobb 500 broiler chicks is shown in Table 4. The result showed that there were significant differences between treatment in FI, BW and FCR in all periods (P≤0.01). According to the Table 4, the FCR of broiler chicks significantly increased (P≤0.01) by feeding E1, E2, E3 and E4. Using different energy source and levels had a significant effect on some carcass traits (P≤0.01) as shown in Table 5. The result of this study showed that carcass, breast, liver, spleen and gizzard percentage increased in treatments compared to the control. The abdominal fat tended to significantly (P≤0.01) increased by using 3 and 6% fat upper level than the control group.

Table 3: Composition (%) of the experimental diets for broiler chicks (29-42 days old)

Ingredients	Control	E1	E2	E3	E4
Corn	70.18	71.47	71.5	65.08	62.4
Soybean meal	19.3	20	24.2	25.8	25
Corn gluten	6.23	4.2	0	1.5	3.5
Soybean oil	0	0	0	3.5	5
Dicalcium phosphate	1.7	1.7	1.7	1.7	1.7
Oyster shell	0.92	0.92	0.92	0.90	0.90
Common salt	0.32	0.32	0.32	0.32	0.32
L-Methionine	0.18	0.22	0.27	0.22	0.20
L- Lysine	0.36	0.36	0.27	0.21	0.22
L-Threonine	0.09	0.09	0.10	0.06	0.04
Mineral and Vitamin premix	0.5	0.5	0.5	0.5	0.5
Choline Chloride	0.16	0.16	0.16	0.16	0.16
Filler	0.06	0.06	0.06	0.05	0.06
Total	100	100	100	100	100
Calculated nutrient content					
ME (kcal/kg)	3185	3085	2990	3185	3275
CP (%)	18	17.4	16.8	18	18.5
Ca (%)	0.76	0.76	0.76	0.76	0.76
P (%)	0.38	0.38	0.38	0.38	0.38
Met (%)	0.48	0.48	0.48	0.48	0.48
Lys (%)	0.95	0.95	0.95	0.95	0.95
Met + Ces (%)	0.74	0.74	0.74	0.74	0.74
Thr (%)	0.65	0.65	0.65	0.65	0.65
Trp (%)	0.16	0.16	0.17	0.17	0.17
Arg (%)	1.02	1.02	1.03	1.03	1.03
Val (%)	0.73	0.73	0.74	0.74	0.74
Na (%)	0.16	0.16	0.16	0.16	0.16
K (%)	0.6	0.6	0.7	0.71	0.7
Cl (%)	0.29	0.29	0.28	0.28	0.28

E1: Basal diet with 3% lesser energy than control, E2: basal diet with 6% lesser energy than control, E3: basal diet based on corn and fat level according to Cobb 500 instruction manual, E4: basal diet based on corn and fat with 3% upper energy.

Discussion

In this study using different levels of energy could affect performance and some carcass characteristics in experimental Cobb 500 broilers. Ajuyah et al. (1993) noted that an increase in the saturation of the diet decreased the weight gain and final weights, although controversial results have been reported elsewhere. Palmer (1990) showed that the improvement of performance and growth of poultry may be due to the inclusion of some oils which may affect muscle protein synthesis. Richards (2003) reported that broilers selected both for rapid weight gain and muscle mass deposition do not properly regulate voluntary feed intake according to energy level. Danicke et al (1997) reported that the performance was higher in broilers that received a soybean meal oil based diet that was supplemented with an enzyme compared with un-supplemented tallow based diets. Abudabos (2014) showed that during the starter period, FI was not affected by fat source, energy level or enzyme

Table 4: The effect of the energy source on performance of Cobb 500 broiler chicks (gr/day)

Treatments	Starter (0-14)				Grower (14-21)				Finisher (21-42)			
---------	BW(g)	FI(g)	FCR	FER	BW(g)	FI(g)	FCR	FER	BW(g)	FI(g)	FCR	FER
Control	24.41^{a}	28.64^{b}	1.14^{e}	0.85^{a}	45.67^{b}	62.75^{bc}	1.34^{e}	0.72^{a}	51.42^{b}	86.11^{b}	1.65^{d}	0.60^{a}
E1	22.92^{b}	29.07^{b}	1.25^{b}	0.78^{c}	42.82^{c}	66.85^{ab}	1.52^{b}	0.64^{c}	49.83^{c}	86.88^{b}	1.70^{b}	0.56^{d}
E2	21.64^{c}	28.92^{b}	1.31^{a}	0.74^{d}	38.78^{d}	65.25^{ab}	1.64^{a}	0.62^{d}	48.33^{d}	88.61^{ab}	1.80^{a}	0.53^{e}
E3	23.50^{ab}	28.85^{b}	1.20^{d}	0.81^{b}	44.39^{b}	61.32^{c}	1.40^{d}	0.72^{a}	51.50^{b}	87.30^{b}	1.64^{e}	0.57^{c}
E4	23.14^{a}	30.57^{a}	1.22^{c}	0.75^{d}	47.75^{a}	68.07^{a}	1.41^{C}	0.70^{b}	53.80^{a}	91.10^{a}	1.66^{c}	0.58^{b}
SEM	0.091	2.10	0.021	0.005	5.36	6.10	0.116	0.004	4.32	5.36	0.053	0.006

*Means within row with no common on letter are significantly different (P≤0.01); E1: Basal diet with 3% lesser energy than control, E2: basal diet with 6% lesser energy than control, E3: basal diet based on corn and fat level according to Cobb 500 instruction manual, E4: basal diet based on corn and fat with 3% upper energy.

Table 5: The effect of the energy source on carcass characteristics percentage at 42 days old of Cobb 500 broiler chicks

Treatments	(Percentage)					
---------	Carcass	Breast	Liver	Spleen	Abdominal fat	gizzard
Control	71.80^{c}	24.03^{a}	2.55^{c}	0.32^{d}	2.56^{d}	2.75^{c}
E1	72.10^{b}	23.97^{a}	2.42^{d}	0.35^{c}	2.70^{e}	2.77c
E2	72.00^{b}	23.92^{a}	2.31^{e}	0.38^{b}	2.80^{c}	2.80^{b}
E3	72.12^{a}	23.97^{a}	2.92^{b}	0.39^{b}	2.75^{b}	2.89^{b}
E4	72.28^{a}	24.01^{a}	3.01^{a}	0.42^{a}	2.81^{a}	2.90^{a}
SEM	0.458	0.005	0.121	0.004	0.524	0.010

*Means within row with no common on letter are significantly different (P≤0.01); E1: Basal diet with 3% lesser energy than control, E2: basal diet with 6% lesser energy than control, E3: basal diet based on corn and fat level according to Cobb 500 instruction manual, E4: basal diet based on corn and fat with 3% upper energy

supplementation or their interactions (P≥0.05), but FI was influenced by the energy level of the diet at finisher period (P≤0.05). Murugesan et al (2013) showed that direct comparison of the excess energy contributed by the 3% diets provided an average of 69% increase over the energy value derived from the equations. Haunshi et al. (2012) determined that to obtain better FCR, feeding birds with diet having 2,800 kcal/kg ME and 16% CP would be ideal. Nwoche et al. (2001) evidenced that 4% dietary inclusion of palm oil as the best inclusion level that will bring about an optimum growth in broilers. This finding is in agreement with Boekholt et al. (1994) who also found a reduction in fat deposition due to a decrease in dietary energy: protein ratio and lead to worth performance in broiler chicks.

Leeson et al. (1996) showed that the increase in feed consumption associated with low energy diets can affect growth and meat yield. Nahashon et al. (2005) showed that on 3100 and 3150 kcal of ME/kg of diet at 0 to 4 weeks exhibited greater (P≤0.01) body weight, greater carcass and breast weights (P≤0.05). Leeson et al. (1996) found an increase in the dietary energy level followed by higher abdominal fat deposition. Deaton and Lott (1985) indicated that the amount of abdominal fat as a percentage of body weight increased with the age (36 to 54 days) and dietary energy level (3100 to 3325 metabolizable energy kcal/kg). Potença et al. (2008) suggest that there is no influence of animal or vegetable dietary lipid sources on performance, abdominal fat deposition, or tibia density and strength in broilers.

Conclusion

We can conclude that the current nutritional recommendations in Cobb 500 broiler chicks' instruction manual are not sufficient for realizing the full genetic potential of these broiler strains to gain higher body weight gain and better feed conversion ratio.

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