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EFFECT OF FEEDING HIGH DIETARY ENERGY LEVELS ON PRODUCTIVE PERFORMANCE OF BROILER CHICKS DURING THE FINISHER PERIOD

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ABSTRACT: *This work was conducted to study the effect of feeding high dietary energy levels on productive performance of broiler chicks during the finisher period. Two hundred and forty unsexed Hubbard broiler chicks at four weeks of age were divided into four treatments (60 bird each); each treatment contained 6 replicates of 10 birds.*

The experimental treatments were as follows:

***1**: Chicks were fed diet containing 3135 Kcal/Kg diet from 22 to 42 days of age. **2**: Chicks were fed diet containing 3320 Kcal/Kg diet from 22 to 42 days of age. **3**: Chicks were fed diet containing 3320 Kcal/Kg diet from 29 to 42 days of age. **4**: Chicks were fed diet containing 3320 Kcal/Kg diet from 36 to 42 days of age.*

Results obtained could be summarized in the following:

No significant difference among dietary treatments was recorded for live body weight but significant improvement in live body weight gain between 22 and 42 days of age were observed. The high energy diets significantly affected feed intake (FI) during the period from 22 to 42 days. Chicks fed the control diet had lower FI value during this period, while chicks fed the diet containing high dietary energy levels (3320 kcal/kg diet for two weeks) had highest FI value during the same period. No significant difference among dietary treatments in growth rate; performance index and chemical composition of broiler meat and carcass traits were observed. The results indicated insignificant effects of high dietary energy levels on serum constituents except that total protein and globulin had significant effect. Economical efficiency value at 6 weeks of age was improved with broilers fed high energy diet (3320 kcal/kg diet) for one week as compared with the control group.

***In conclusion,** feeding a high energy diet (3320 kcal/kg diet) resulted in greater gross feeding margins with broilers fed for one week (36 to 42 days).*

INTRODUCTION

It is a widely accepted principle in poultry nutrition that dietary energy and the essential nutrients must be considered as an entity. A change in the energy content of the diet will normally result in an inverse change in the total amount of feed consumed and will therefore influence the intake of essential nutrients **(Slagter and Waldroup, 1990)**. **Hunton (1995)** found that nutrients intake can be influenced by different levels of energy in diet. Therefore, deficiency of nutrients may occur in poultry by increasing the energy content in diet. In contrast, feed intake as well as nutrients utilization are increased by low level of energy in the diet. Broiler chickens have traditionally been fed relatively high energy diets, because, in addition to promoting efficient feed utilization, it is also assumed that this type of diet maximizes growth rate **(Leeson and Summers, 1991).**

It is generally assumed that when birds eat more, they have greater body weights at market age. The improvement noted in market body weight has been attained due to an increase in feed consumption, which is related to genetics **(Havenstein *et al.*, 1993)** and supported by nutrition. This improvement in body weight for modern broiler chickens at marketing age, due to an increase in growth rate which is associated with higher nutrient supply.

The challenge in growing efficient broilers for today's market involves maintaining a high rate of growth to achieve market weight at an early age, while avoiding reduced feed efficiency, increased fat deposition and higher mortality rate. The market age of broilers in Egypt is currently between 42 and 49 days. As there is no market benefit for reduced carcass abdominal fat present, most producers being paid on the basis of body weight. Furthermore, there may be resistance within the broiler industry to adopting severe feed restriction regimes **(Newcombe *et al.*, 1992).**

Although the most practical method for increasing energy density in poultry diets were achieved by the addition of fats and oils (**Hill and Dansky, 1954**), there are significant differences in the metabolism of fat and carbohydrates. The relatively low specific dynamic action of fat is suggested as a reason for growth response of substituting dietary carbohydrates by fat **(Carew and Hill, 1964)**. Other beneficial effects of fat in improving energy utilization were due to retardation of the rate of intestinal feed passage allowing for better absorption of nutrients from the gut. **(Mateos and Sell,**

1981). Fat is also reported to enhance feed efficiency via an "extera caloric" effect with older turkeys **(Jensen *et al*., 1970)**. On the other hand, there are differences in digestion and absorption of dietary fat as older chicks can utilize fat more efficiently than younger ones **(Turner *et al.*, 1999)**.

A little work has been done on the effect of dietary energy level on the performance of broiler chickens at market age in Egypt. Therefore, the aim of this investigation was to study the effect of feeding high dietary energy levels on productive performance of broiler chicks during the finisher period.

MATERIALS AND METHODS

This work was carried out at El Takamoly Poultry Project, Fayoum, Egypt, to study the effect of feeding high energy diets on productive performance of broiler chicks during the finisher period. Chemical analyses were performed in the laboratories of the Poultry Department, Faculty of Agriculture, Fayoum University, according to procedures outlined by **A.O.A.C. (1990).**

Two hundred and forty unsexed Hubbard broiler chicks at four weeks of age were divided into four treatments (60 bird each); each treatment contained 6 replicates of 10 birds.

The experimental treatments were as follows:

1: Chicks were fed diet containing 3135 Kcal/Kg diet from 22 to 42 days of age .

2: Chicks were fed diet containing 3320 Kcal/Kg diet from 22 to 42 days of age .

3: Chicks were fed diet containing 3320 Kcal/Kg diet from 29 to 42 days of age .

4: Chicks were fed diet contained 3320 Kcal/Kg diet from 36 to 42 days of age .

The experimental diets were supplemented with minerals and vitamins premix along with L-lysine and DL-methionine to cover the recommended requirements according to feed composition tables for animals and poultry feedstuffs used in Egypt **(CLFF, 2001)** as shown in Table 1. The finisher diet were formulated to be iso-nitrogenous. Chicks were individually weighed, wing-banded and randomly allotted to dietary treatments. Chicks were raised in electrically heated batteries with raised wire mesh floors and had free access to feed and water. Batteries were placed into a room provided with continuous light and fans for ventilation. Birds were reared under similar managerial conditions and were given the experimental diets from the end of the fourth week i.e., 22 days until 42 days (finisher diets), while chicks were fed the control diet during the other periods.

Birds were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed consumption was recorded and feed conversion (g feed/g gain) and body weight gain were calculated. Crude protein conversion (CPC), caloric conversion ratio (CCR), specific gravity and performance index were also calculated **(Ragab, 2001)**.Growth rate (GR), was calculated using the following formula according to the equation of **Larner and Asundson (1932):**

$$\mathbf{GR = ((LBW_2 - LBW_1) / 0.5\ (LBW_2 + LBW_1)) \times 100}$$

Where: LBW_1 and LBW_2 are live body weights at early and late ages studied.

Mortality was recorded daily during finishing period. At the end of the experiment (42 days), a slaughter test was performed using six chicks around the average LBW of each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the carotid artery and jugular veins (islamic method). After four minutes of bleeding, each bird was dipped in a water bath for two minutes and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass traits, dressing% and total giblets % (gizzard, liver, spleen and heart). The abdominal fat was removed from parts around the viscera and gizzard, and was weighed to the nearest gram. Chemical analyses of representative samples of the experimental carcass meat (without skin) were carried out to determine percentages of dry mater (DM), crude protein (CP) (N x 6.25), either extract (EE), crude fiber (CF) and ash contents according to the methods of **A.O.A.C (1990).** Nitrogen free extract (NFE) was calculated by difference (Table 3).

Individual blood samples were collected during exsanguinations, immediately centrifuged at 3500 rpm for 15 min. Serum samples were harvested after centrifugation of the clotted blood, stored at–20Ċ in the deep freezer until the time of chemical determinations. The biochemical characteristics of blood were determined colorimetrically using commercial kits. Total protein **(Weichselbaum, 1946);** albumin **(Drupt, 1977);** cholesterol **(Allain,**

1974); triglycerides **(Werner *et al.*, 1981);** aspartate aminotransferase (AST) and alanine aminotransferase (ALT) **(Reitman and Frankel, 1957);** calcium **(Baver, 1981);** glucose **(Trinder, 1964)** were determined. Globulin concentration was calculated as the difference between total protein and albumin.

To determine the economical efficiency for meat production, the amount of feed consumed during the experimental period was obtained and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time (Jan. to Feb., 2005). Analysis of variance was conducted according to **Steel and Torrie (1980).** Significant differences among treatment means were determined using Duncan's multiple range test **(Duncan, 1955).** This model (one-way) was used for the analysis of variance to estimate the effect of different levels of high energy diets as follows : **Yij = µ +Ti + eij**

Where: **Yij** = the observations. **µ** = overall mean.

Ti = effect of each treatment **eij** = residual (random error).

RESULTS AND DISCUSSION

Productive performance:

Live body weight (LBW), live body weight gain (LBWG) and feed intake (FI): Results in Table 2 revealed no significant differences among dietary treatments in LBW but significant improvements ($P \leq 0.05$) in LBWG between 22 and 42 days of age were observed. On the other hand, LBW (insignificant) and LBWG (significant) were increased with increasing energy/protein ratio. Lower LBWG was recorded in the control group. The high energy diets significantly affected ($P \leq 0.01$) feed intake (FI) during the period from 22 to 42 days of age. Chicks fed the control diet had the lowest FI value during this period (this result may be due to the low LBWG value recorded for the control group during this period). While chicks fed the high energy diets (3320 kcal/kg diet for the last two weeks) had the highest value FI during the period from 22 to 42 days of age (the improvement noted in market body weight has been attained due to an increase in feed consumption). These results agree with the finding of **Jensen *et al.* (1970) and Fisher and Wilson (1974)** who found that an "extra caloric" effect for the supplemented of fat and suggested that wide caloric/protein ratios in poultry ration with additional fat can be used for maximum gain and feed efficiency. Also, previous research has established that feeding broilers diets containing apparent metabolizable energy (AME) concentrations improved LBW **(Jackson *et al.* (1982); Leeson *et al.* (1996); Cheng *et al.* (1997) and Hidalgo *et al.* (2004)).**

In this respect, the effect of energy levels on Single Comb White Leghorn pullets was studied by **Hussein *et al.* (1996).** They reported that high dietary energy level significantly increased LBWG. The same conclusion was reached by **Greenwood *et al.* (2004)** as they found that birds fed 3200 Kcal ME /Kg diet had greater LBWG than those fed 3050 Kcal ME/kg diet. **Nahashon *et al.* (2005)** stated that French guinea broilers fed 3100 and 3150 Kcal ME/kg diet exhibited significantly greater LBWG than those fed 3050 Kcal ME/kg diet. During the finishing period, increasing energy level significantly increased LBW and LBWG **(Elmansy, 2006).** In contrast, **Saxena and Thakur (1985)** concluded that LBW and LBWG were not significantly affected by dietary energy levels (2800, 2900 or 3000 Kcal ME/kg diet).

Abreu *et al.* (1996); Nahashon *et al.* (2005) and Elmansy (2006) concluded that during the finishing period, broiler fed diets with 3200 Kcal ME/kg diet had the best FI value.

Feed conversion (FC), crude protein conversion (CPC) and caloric conversion ratio (CCR): Results in Table 2 revealed no significant differences among dietary treatments in FC, CPC and CCR**.** **Reece *et al.* (1984 and 1985)** elicited that the highest level of ME (3109 Kcal ME/kg diet) improved FC by 2.2 and 2.6%, respectively. Also, **Leeson, *et al.* (1996); Nahashon *et al.* (2005) and Elmansy (2006)** showed that FC significantly improved with increasing energy level (3200 Kcal ME/kg diet) during the finishing period.

Growth rate (GR) and performance index (PI): Data presented in Table 2 showed that high energy diets insignificantly affected GR and PI during the period from 22 to 42 days of age. The present results suggest that GR of broiler chickens are related to FI while, the change in body weight of birds be positively correlated to FC. Also**,** from the obtained results it could be concluded that there was a positive relationship (not significant) between the high energy level and GR and PI during the period from 22 to 42 days of age.

Generally, from the results presented in Table 2, it may be noticed that the FC, CPC, CCR, GR and PI of broilers fed the high energy diet improved (P>0.05) with increasing energy compared to those fed the control diet. However, determination of the dietary energy content should be made on economic and not biological criteria. There has been no agreement with **Cerrate *el al.* (2007)** who reported that the nutrient requirements of broilers are basically determined as a function of the best performance such as LBW or FC.

Chemical composition of broiler meat%: Results in Table 3 revealed no significant difference among dietary treatments in chemical composition of broiler meat %. From the obtained results it could be concluded that fat percentage gradually increased (not significant) with increasing energy level. Similar results were obtained by **Bartov *et al.* (1974) and Nelson (1980)** who reported that widening the dietary calorie/protein ratio increases fat deposition in broilers and narrowing the dietary calorie/protein ratio decreases fat deposition.

Carcass traits: As shown in Table 3, no significant difference are detected among dietary treatments in the carcass traits. Therefore, it is likely that the high dietary energy levels in the present study may not have differed enough to cause a significant difference in carcass traits.

In this respect, **Ayorinde (1994); Leeson *et al.* (1996) and Raju *et al.* (2004)** found that the percentage of abdominal fat was significantly increased as the dietary energy level increased. Also, **Nahashon *et al.* (2005)** found that carcass significantly improved by increasing dietary energy levels. **Shrivastav and Panda (1991)** confirmed that fat content of whole carcass was significantly increased with increasing energy content of diet.

Serum constituents: The results in Table 3 indicated insignificant effects of high energy diets on serum constituents except that total protein ($P \leq 0.01$) and globulin ($P \leq 0.05$) had significant effect. Chicks fed diets containing high energy level (3320 kcal/kg diet for the last three weeks or two weeks (29 to 42 days)) had the highest values of total protein and globulin. In contrast, **Elmansy (2006)** reported that the higher level of energy (3200 Kcal ME/kg diet) induced a higher level of triglyceride and cholesterol.

Mortality rate: The dietary treatments had no effect on mortality rate. Similarly, **Hussein *et al.* (1996)** and **Elmansy (2006)** found that mortality was not affected by different energy level used during the final 4 weeks of age.

Economical efficiency (EEF): Results in Table 4 showed that EEF value at 6 weeks of age was improved with broilers fed high energy diet (3320 kcal/kg diet) for one week (36 to 42 days of age) as compared with the control group. As a result, the increase in gross margin was probably due to the reduction in feed consumption and slightly improvement in LBW, LBWG and FC when compared with the control group. In this respect**, Dozier *et al.* (2006)** demonstrated that no economic benefit was realized by increasing dietary AME beyond 3220 kcal/kg with changing diet and meat prices**.** Also, **Abdel-Samai *et al.* (2007)** reported that economical efficiency as determined by feed cost/kg weight gain was decreased linearly as fat supplementation increased in the diets (indicating higher cost with supplemental fat).

General conclusions: feeding high energy diet (3320 kcal/kg diet) resulted in greater gross feeding margins with broilers fed for one week (36 to 42 days)

Table 1: Composition and calculated analyses of the experimental diets.

Item, %	Starter diet (from 1 to21 days	Finisher diet(from 22 to 42 days)	Finisher diet (high energy from 22 to42 days)
Yellow corn, ground	61.00	66.30	65.40
Soybean meal (44 %CP)	35.50	26.00	22.00
Corn gluten meal (60%CP)	0.00	1.00	4.00
Vegetable oil	0.00	3.00	5.00
Di – calcium phosphate	1.70	1.70	1.70
Calcium carbonate	1.10	1.20	1.10
Sodium chloride	0.30	0.30	0.30
Vit. and Min. premix *	0.30	0.30	0.30
DL – Methionine 99%	0.10	0.16	0.13
L-Lysine hydrochloride 78%	0.00	0.04	0.07
Total	100	100	100
Calculated analysis (%)** :			
CP	20.86	17.81	17.79
EE	2.67	5.80	7.81
CF	2.73	2.49	2.35
Ca	0.93	0.95	0.90
Available P	0.43	0.42	0.41
Methionine	0.46	0.47	0.45
Methionine +Cystine	0.83	0.79	0.79
Lysine	1.21	0.99	0.93
ME, K cal/Kg	2839	3135	3320

*Each 3.0 Kg of the Vit. and Min. premix manufactured by Agri-Vet Company, Egypt and contains : Vit. A, 12000000 IU ; Vit. D3 2000000 IU ; Vit. E, 10 g ; Vit. K3, 2.0 g ; Vit. B1, 1.0 g ; Vit. B2, 5 g ; Vit. B6, 1.5 g; Vit. B12,10 mg ; choline chloride, 250 g ; biotin, 50 mg ; folic acid, 1 g ; nicotinic acid , 30 g ; Ca pantothenate, 10 g ; Zn, 50 g ; Cu,10 g ; Fe, 30 g ; Co, 100 mg ; Se, 100 mg ; I, 1 g ; Mn, 60 g and anti-oxidant, 10 g, and complete to 3.0 Kg by calcium carbonate.
** According to NRC, 1994.

Table (2): Live body weight, live body weight gain, feed intake, feed conversion, crude protein conversion, caloric conversion ratio, growth rate, performance index and chemical analysis of carcass meat % (Mean ± SE) of broiler chicks as affected by feeding high energy diets during the finisher period.

Item / Treatments	3135 Kcal/Kg diet from 22 to42 days	3320 Kcal/Kg diet from 22 to 42 days	3320 Kcal/Kg diet from 29 to42 days	3320 Kcal/Kg diet from 36 to 42 days	Over all mean
Live body weight					
42 days	2146.5±38.0	2235.1±35.1	2278.2±36.4	2216.9±37.6	2219.2±18.4
Live body weight gain					
22-42 days	1206.4±31.3b	1301.3±29.0a	1322.7±30.1a	1278.9±31.0ab	1277.3±15.2
Feed intake					
22-42 days	2893.5±11.6C	2917.0±10.7BC	3005.8±11.1A	2943.8±11.4B	2940.0±5.60
Feed conversion					
22-42 days	2.40±0.06	2.24±0.06	2.27±0.06	2.30±0.06	2.30±0.03
Crude protein conversion					
22-42 days	0.471±0.01	0.432±0.01	0.442±0.01	0.453±0.01	0.449±0.01
Caloric conversion ratio					
22-42 days	8.16±0.22	7.93±0.20	7.96±0.21	8.00±0.22	8.01±0.11
Growth rate					
22-42 days	0.272±0.01	0.288±0.01	0.287±0.01	0.283±0.01	0.283±0.002
Performance index					
22-42 days	74.20±3.04	81.46±2.81	81.36±2.92	78.74±3.01	78.94±1.48
Caloric / protein ratio					
22-42 days	176.19	186.62	183.14	179.67	181.41

a, …b, and A,… C, values in the same row within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to C).

Table (3): Chemical analysis of carcass meat %, carcass traits and serum constituents (Mean ± SE) of broiler chicks as affected by feeding high energy diets during the finisher period.

Item / Treatments	3135 Kcal/Kg diet from 22 to42 days	3320 Kcal/Kg diet from 22 to 42 days	3320 Kcal/Kg diet from 29 to42 days	3320 Kcal/Kg diet from 36 to 42 days	Over all mean
Chemical analysis of carcass meat %					
Moisture	72.66±0.61	73.71±0.61	73.35±0.61	72.43±0.61	73.04±0.31
Protein	19.68±0.86	18.16±0.86	19.69±0.86	19.63±0.86	19.29±0.43
Fat	2.64±0.39	3.54±0.39	3.12±0.39	2.86±0.39	3.04±0.20
Ash	1.04±0.07	0.95±0.07	0.93±0.07	1.16±0.07	1.02±0.03
NFE	3.98±0.56	3.64±0.56	2.91±0.56	3.92±0.56	3.61±0.28
Carcass traits					
Liver %	1.91±0.11	1.92±0.11	2.31±0.11	2.26±0.11	2.10±0.06
Gizzard%	1.89±0.12	1.74±0.12	1.90±0.12	2.18±0.12	1.93±0.06
Spleen %	0.144±0.03	0.188±0.03	0.173±0.03	0.176±0.03	0.170±0.01
Heart %	0.498±0.04	0.574±0.04	0.517±0.04	0.531±0.04	0.530±0.02
Total giblets %	4.45±0.19	4.42±0.19	4.90±0.19	5.15±0.19	4.73±0.10
Abdominal fat %	2.51±0.32	2.74±0.32	2.63±0.32	2.10±0.32	2.49±0.16
Carcass %	71.42±1.24	69.81±1.24	69.34±1.24	68.90±1.24	69.87±0.62
Dressing %	75.87±1.18	74.23±1.18	74.24±1.18	74.05±1.18	74.60±0.59
Specific gravity	1.032±0.002	1.027±0.002	1.029±0.002	1.029±0.002	1.03±0.001
Serum constituents					
Calcium mmol/L1	2.46±0.80	2.90±0.80	2.52±0.80	3.58±0.80	2.87±0.40
Cholesterol Mg2%	111.54±15.1	122.12±15.1	109.62±15.1	128.85±15.1	118.03±7.5
Triglycerides mmol/L	2.14±0.36	2.75±0.36	3.06±0.36	2.20±0.36	2.54±0.18
AST U/ml3	32.00±5.36	38.50±5.36	42.50±5.36	36.50±5.36	37.38±2.68
ALT U/ml	19.00±2.66	22.50±2.66	23.00±2.66	15.00±2.66	19.88±1.33
Total protein g/L4	28.89±2.62B	50.00±2.62A	45.00±2.62A	28.89±2.62B	38.19±1.31
Albumin g/L	18.85±3.20	21.50±3.20	12.61±3.20	18.27±3.20	17.81±1.60
Globulin g/L	10.04±3.13b	28.50±3.13a	32.39±3.13a	10.62±3.13b	20.39±1.56
Glucose mmol/L	8.55±1.50	7.37±1.50	9.97±1.50	7.32±1.50	8.30±0.75

a, …b, and A,… B, values in the same row within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to B).

1 Millimoll / Liter, 2 Milligram%, 3 Unit / Milli, 4 Gram / Liter.

Table (4) : Economical efficiency of broiler chicks as affected by feeding high energy diets during the finisher period.

Item / Treatments	3135 Kcal/Kg diet from 22 to42 days	3320 Kcal/Kg diet from 22 to 42 days	3320 Kcal/Kg diet from 29 to42 days	3320 Kcal/Kg diet from 36 to 42 days
Average feed intake (Kg/bird) a	2.894	2.917	3.006	2.944
Price / Kg feed (P.T.) b	124.9	135.9	132.5	128.8
Total feed cost (P.T.) = a x b = c	361.46	396.42	398.30	379.19
Average LBWG (Kg/ bird) d	1.206	1.301	1.323	1.279
Price / Kg live weight (P.T.) e	700	700	700	700
Total revenue (P.T.) = d x e = f	844.2	910.7	926.1	895.3
Net revenue (P.T.) = f - c = g	482.74	514.28	527.81	516.11
Economical efficiency =(g /c)	1.336	1.297	1.325	1.361
Relative efficiency r	100	97.14	99.22	101.92

b ……..….(based on average price of diets during the experimental time).
e.................(according to the local market price at the experimental time).
(g /c)...........(net revenue per unit feed cost).
r ………….(assuming that economical efficiency of the control group (1) equals 100).

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الملخص العربي

تأثير التغذية علي علائق تحتوي علي مستويات مرتفعه من الطاقة علي الأداء الإنتاجي لبداري التسمين خلال فترة الناهي

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أجري هذا البحث لدراسة تأثير التغذية علي علائق مرتفعة الطاقة علي الأداء الإنتاجي لبداري التسمين خلال فترة الناهي .استخدم عدد 240 كتكوت غير مجنس من النوع هبرد عمر أربع أسابيع ، قسمت الكتاكيت إلي أربع معاملات (60طائر/معاملة) ، كل معاملة اشتملت علي 6 مكررات وكل مكرر به 10 طائر. وكانت المعاملات التجريبية كما يلي:-

1- غذيت الكتاكيت علي عليقة تحتوي علي 3135 ك ك /كجم عليقة من عمر 22 إلي 42 يوم.

2- غذيت الكتاكيت علي عليقة تحتوي علي 3320 ك ك /كجم عليقة من عمر 22 إلي 42 يوم.

3- غذيت الكتاكيت علي عليقة تحتوي علي 3320 ك ك /كجم عليقة من عمر 29 إلي 42 يوم.

4- غذيت الكتاكيت علي عليقة تحتوي علي 3320 ك ك /كجم عليقة من عمر 36 إلي 42 يوم.

والنتائج المتحصل عليها يمكن تلخيصها في الأتي:

1- لم يكن هناك أي فرق معنوي بين المعاملات التجريبية بالنسبة لـ وزن الجسم الحي ، بينما كان هناك تحسن معنوي بالنسبة لـ وزن الجسم المكتسب خلال الفترة من 22 إلي 42 يوم من العمر. كان للتغذيه علي العلائق المرتفعة الطاقة تأثير معنوي بالنسبة لـ استهلاك الغذاء خلال الفترة من عمر 22 إلي 42 يوم. كان للكتاكيت التي تغذت علي عليقة الكنترول اقل مستوي من استهلاك الغذاء خلال تلك الفترة ، بينما أظهرت الكتاكيت التي تغذت علي العلائق المرتفعة الطاقة (3320 ك ك /كجم عليقة لمدة أسبوعين) أعلي قيمة بالنسبة لاستهلاك الغذاء خلال تلك الفترة . 2- لم يكن هناك أي فرق معنوي بين المعاملات التجريبية بالنسبة لـ لمعدل النمو ، للأداء الإنتاجي ، التحليل الكيمائي للحم أو صفات الذبيحة.3- وتشير النتائج إلي أنه لم يكن هناك أي تأثير معنوي علي مكونات السيرم فيما عدا التأثير المعنوي علي البروتين والجلوبيولين الكلي. 4-أدت التغذية علي العلائق المرتفعة الطاقة (3320 ك ك /كجم عليقة لمدة أسبوع) إلي تحسن الكفاءة الإقتصادية عند عمر 6 أسابيع بالمقارنة بعليقة الكنترول.

ويستخلص من هذه الدراسة: أن التغذية علي العلائق المرتفعة الطاقة (3320 ك ك /كجم عليقة لمدة أسبوع (من 36 إلي 42 يوم)) أدت إلي تحسن الأداء الإنتاجي والكفاءة الاقتصادية لبداي التسمين.