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# CARCASS CHARACTERISTICS AND SOME BIOCHEMICAL VARIABLES IN BROILER CHICKS AS AFFECTED BY AN INITIAL FEED RESTRICTION AND SUBSEQUENT EFEEDING

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## ABSTRACT

A total number of 72 unsexed one-day-old broiler chicks were divided equally into four groups (each of 18 chicks) and fed the starter recommended diet (1) during the first week of age. Then , from 14 to 21 days of age , birds where allocated to three tested energy-protein restriction diets representing 90%, 80% or 70% of starter requirements (groups 2 ,3 and 4 ), compared to those fed 100% of the starter requirements (control). Then, birds were switched again to the control starter diet (1). All birds were fed grower and finisher diets from 22 to 37 and from 38 to 49 days of age, respectively. Body weight, carcass characteristics, carcass analysis and serum biochemical variables were taken at the end of experimental period (49 days of age).

**Results obtained can be abstracted as follow:**

1-Body weight, relative weight values of carcass, liver, gizzard, kidney and heart did not significantly affected by levels of energy-protein restriction used in the current study.

2-Abdominal fat percentage was declined gradually and significantly ($P<0.05$) as feed restriction level increased.

3-Commercial carcass cuts (breast and thigh muscles) yielded a higher ($P >0.05$) percentage distribution for breast portion and less ($P>0.05$) percentage distribution for thighs than the control group.

4-Dry matter and ash content were nearly similar in all groups, while protein content insignificantly increased with increasing energy-protein restriction levels. However, ether extract of control group recorded the highest value compared to the others.

5-Serum total protein, albumin, globulin and uric acid content exhibited insignificant values in treatment groups.

6-Total cholesterol, triglycerides, HDL and LDL levels in restricted feed broilers were concomitant with those of body fat content and abdominal fat.

7-Serum glucose, T3 and T4 levels were insignificantly fluctuating in broilers fed different feed restriction regimes.

It could be suggested that the effect of feed restriction in broilers at an early age is more evident in lipid metabolism rather than protein metabolism, to obtain a better understanding of their nutritional and physiological responses.

## INTRODUCTION

Constant genetic selection and improvement in nutrition led to a very fast growth in modern broiler strains. Over the last 40 years the time required to grow a broiler chicken to 2 kg body weight has decreased by about one day per year (Portsmouth and Hand, 1987). This dramatic increase in growth rate is manifested primarily in the first four weeks after hatching (Marks, 1979). Unfortunately, early fast growth rate in broiler chicks is accompanied by a number of problems – namely, increased body fat deposition, a high incidence of metabolic diseases, high mortality, and a high incidence of skeletal disorders (Lippens, 2001; Lippens *et al.*, 2000 and Shariatmadari and Torshizi, 2004).These conditions are more commonly observed in fast growing broilers that are fully fed.

Broiler chicks fed *ad libitum* likely consume energy at two or three times greater than their maintenance need (Boekholt *et al.*, 1994) and so fat deposition is increased. This fact is of economical concern because fat represents an undesirable and uneconomical product. There is pressure on the broiler chicken industry to reduce the fat content of the product owing to the consumer awareness of dietary fat and its perceived adverse effect on human health. Early life feed restriction programs have been investigated to reduce the carcass fat of 49 days old broilers without causing loss of body weight ( Plavnik and Hurwitz, 1988 and Jones and Farrell, 1992). The use of feed restriction is a viable way to make an alternation in the growth profile of broilers (Whitehead, 2002) by reducing body fat. Full body weight recovery may be more consistently realized if a number of short restriction periods are used rather than a long, continuous period, which results in improvement of the efficiency to lean tissue deposition and energy retention (Farrell and Williams, 1989).

Compensatory growth can be defined as the increase in growth rate commonly observed after a period of nutritional limitation (Kamalzadeh, 1996). Feed restriction at early age, followed by a period of compensatory growth may provide an effective practical and economically viable approach to decrease problems associated with early life fast growth in broiler chicks, e.g. a high incidence of metabolic disorders. Moreover, the efficiency of growth may be improved by such feeding strategies due to lower fat deposition, reduction in abdominal fat pad content and lower maintenance requirement for energy (Zubair and Leeson, 1996 and Susbilla *et al.*, 2003).

A knowledge of blood parameter is of high practical important and routinely used in poultry to permit the study of the specific metabolic and anabolic alterations related to the physiological control mechanisms that ultimately affected carbohydrate, protein and lipid metabolism particularly during the growing periods (Meluzzi *et al.*, 1992 and Ozek and Bahtiyarca, 2004).Therefore, this experiment aimed to:

1- Study the effect of feed restriction during the second week of age on carcass characteristics and carcass fat deposition.
2- Clarify whether or not feed restriction could affect the metabolic functions in broiler chicks as measured by the changes in some biochemical variables related to protein and lipid metabolism.

## MATERIALS AND METHODS

A total of seventy two day old chicks of a commercial strain were selected for nearly similar live body weight and were wing banded. They were divided into four groups of eighteen chicks each, they were maintained in individual cages. All groups were fed on the starter recommended diet **(1)** during the first week of experimental period. Then, three tested energy – protein restriction diets representing 90%, 80% or 70% of starter recommended requirements were offered to the birds of groups**(2,3or 4)**, respectively during the second week of age. Between 14 to 21 days, the birds of treatment groups were switched again to the control starter diet(1). All birds were fed the same grower and finisher diets from 22 to 37 and from 38 to 49 days of age, respectively. The composition of experimental diets and their calculated analysis are presented in Table (1).

**Table (1): Composition and calculated analysis of the experimental diets.**

| Ingredients % | Treatments | | | | | |
|---|---|---|---|---|---|---|
| | Starter (0-21 day) | | | | Grower | Finisher |
| | 1 | 2 | 3 | 4 | | |
| Yellow corn | 53.47 | 57.67 | 47.13 | 35.68 | 60.16 | 59.98 |
| Soybean meal (44%) | 30.00 | 33.00 | 25.09 | 13.99 | 24.25 | 28.84 |
| Corn gluten meal (62%) | 8.92 | 1.84 | 0.02 | - | 7.36 | 1.84 |
| Wheat bran | - | 3.52 | 24.00 | 46.73 | - | - |
| Mono Calcium phosphate(22.5%) | 1.33 | 1.24 | 0.85 | 0.43 | 1.38 | 1.37 |
| Lime stone | 1.87 | 1.88 | 2.05 | 2.26 | 1.75 | 1.73 |
| Vegetable oil | 3.41 | - | - | - | 4.13 | 5.40 |
| Na Cl | 0.42 | 0.41 | 0.40 | 0.37 | 0.42 | 0.42 |
| DL-methionine | 0.07 | 0.11 | 0.12 | 0.10 | 0.09 | 0.12 |
| L-lysine HCl | 0.21 | 0.03 | 0.04 | 0.14 | 0.16 | - |
| Vit. & Min. Mixture* | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |
| Calculated analysis** | | | | | | |
| Crude protein % | 23.00 | 20.7 | 18.4 | 16.00 | 20.00 | 18.50 |
| ME (Kcal/Kg diet) | 3100.0 | 2790 | 2481 | 2170 | 3200 | 3200 |
| Calcium % | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 |
| Available phosphorus % | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 |
| Methionine % | 0.52 | 0.48 | 0.45 | 0.35 | 0.49 | 0.46 |
| Methionine + Cystine % | 0.91 | 0.82 | 0.77 | 0.64 | 0.83 | 0.77 |
| Lysine % | 1.20 | 1.1 | 0.96 | 0.84 | 1.01 | 0.95 |
| Na % | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 |
| EE % | 6.09 | 2.87 | 3.13 | 3.44 | 6.94 | 8.15 |
| CF % | 3.60 | 4.11 | 5.22 | 6.33 | 3.30 | 3.52 |

* Contains: Vit.A 12 mIU; Vit $D_3$ 2.2 mIU; Vit.E 10g; Vit.$K_3$ 2g; Vit Bl 1g; Vit.$B_2$ 5g; Vit $B_6$ 1.5g; Vit $B_{12}$ 10mg; Niacin 30g; pantothenic acid 10g; Folic acid 1g; Biotin 50mg; Choline 300g; Iron 30g; Iodine 1g; Zinc 50g; Manganese 60g; Copper 4g; Selenium 100 mg; Cobalt 100 mg.

** According to NRC (1994).

At the end of the experimental period (49 days of age), five birds from each treatment were fasted for 12 hours, then were weighed and slaughtered to determine the dressing weight, abdominal fat and commercial carcass cuts (breast and thigh muscles). The whole chicks were processed individually by grinding the entire carcass through a meat grinder and the moisture content was determined by drying for 5 days in a forced – draught oven at 70 °C. Composite samples were analyzed in duplicate for ash, crude protein and fat. The proximate analysis was carried out according to the methods described in A.O.A.C., (1990).

Blood samples were collected from each bird during exsanguinations. Blood serum was separated by centrifugation at 6000 r.p.m for 15 minutes. The obtained serum were decanted into plastic tubes, stoppered tightly and stored at - 20 °C until biochemical determinations were done. Serum total protein and albumin were estimated by colorimetric methods using commercial kits supplied from Bio-merieux, France. Globulin was calculated by substraction of serum albumin from total serum protein values and albumin/globulin ratio (A/G) was calculated. Uric acid was estimated colorimetrically using commercial kits supplied from Pasteur lab. Company.

Serum was also submitted for determinations of total cholesterol, triglycerids and HDL using the specific kits according to guidelines and recommendation of Bogin and keller (1987) . Serum triiodothyronine ($T_3$) and thyroxin ($T_4$) were measured by the radioimmuno assay technique using Caot-A-cout$^{125}$ RIA kits purchased from DPC, CA 90045 – 5597, USA.

Statistical examinations of the data were done by using the linear model (SX, 1992). A simple one way classification analysis followed by least significant difference test (LSD) were used for testing the significance between means.

## RESULTS AN DISCUSSION

**Carcass characteristics:**

Table (2) shows the results of live body weight and carcass characteristics expressed as percentage of body weight. The levels of energy – protein restriction used did not exert any significant effect on body weight or relative weight values of carcass, liver, gizzard, kidney and heart. It must be mentioned that the control group recorded slightly lower values of relative weight of live body, carcass, liver and gizzard than the restricted groups at any studied level. These results are in agreement with those of Leeson *et al.* (1991) who found that feed restriction had no effect on carcass characteristics at 42 and 56 days of age. Zubair and Leeson (1994) reported that the adaptation exhibited by the restricted – refed broilers is the relative enlargement of digestive organs, especially the crop, gizzard and liver which enhance feed intake and help support compensatory growth. In this connection, Eits *et al.* (2001) reported that the broiler chicks that had been restricted in dietary protein had fully compensated in gain and carcass percentage if they were had fed high protein diet during refeeding period.

It can be seen in Table (2) that abdominal fat percentage gradually declined significantly ($P<0.05$) as feed restriction level increased. The present study confirms previous observation of Jones and Farrell (1992) and Zubair and Leeson (1996) who showed that abdominal fat was significantly lower in the feed – restricted birds than in the control birds. These changes in abdominal fat percentage may reflect the reduction in activities of the lipogenic enzymes during periods of feed restriction compared to control group (Santoso, 1995). Abdominal fat decreased in response to feed restriction at an early age as a result of the reduction in the number of fat cells (Zhong et al., 1995). Moreover, Plavnik and Hurwitz (1988) cited substantial reduction in the size of the abdominal fat pad of broilers that was not influenced by nutrition during reelimination . Leeson *et al.* (1991) observed that the diet dilution from 4 to 11 days of age resulted in reduced size of the abdominal fat pad ($P<0.05$). Early diet dilution may reduce adipocyte hyperplasia.

Table (2) : Relative carcass characteristics of broiler chicks at 7 weeks of age as affected by experimental diets.

| Items | Treatments | | | |
|---|---|---|---|---|
| | (1) 100% | (2) 90% | (3) 80% | (4) 70% |
| Live body weight (g/bird) | 2646.3 | 2633.2 | 2639.3 | 2654.2 |
| Carcass % | 78.86 | 79.49 | 79.50 | 79.11 |
| Abdominal fat % | 2.53 [a] | 2.43 [ab] | 2.31 [bc] | 2.21 [c] |
| Liver % | 1.73 | 1.77 | 1.75 | 1.78 |
| Gizzard % | 1.35 | 1.46 | 1.63 | 1.62 |
| Heart % | 0.49 | 0.51 | 0.50 | 0.51 |
| Giblets % | 3.57 | 3.74 | 3.88 | 3.91 |
| Total edible parts % | 82.43 | 83.23 | 83.38 | 83.02 |
| Kidneys % | 0.58 | 0.59 | 0.60 | 0.58 |
| Breast muscles % | 18.09 | 18.16 | 18.45 | 18.48 |
| Thighs % | 16.05 | 15.77 | 15.65 | 15.61 |
| Breast + thighs | 34.14 | 33.93 | 34.10 | 34.09 |

a,b,c ...... Means with different letters in the same row are significantly different ($P < 0.05$)

The effect of feed restriction on commercial carcass cuts of broiler chicks at 49 days of age are presented in Table (2). Results showed that, the carcass of feed restricted groups yielded a higher ($P>0.05$) percentage distribution for breast portion and less ($P>0.05$) percentage distribution for thighs than the control groups. These results are in agreement with those of Lippens *et al.* (2000) who found that the percentage of breast muscle of feed restricted birds was similar to those fed control diet. Lippens and DeGroote (2000) concluded that when compensatory growth was sufficient to reach similar final body weights as the control group, breast meat percentages were not significantly changed.

**Carcass analysis:**

The average values for carcass analysis of the different treatments are shown in Table (3). The average values of dry matter and ash content were nearly similar in all groups. There were insignificant differences among the different groups in moisture percentages of whole carcass of the broilers at 7 weeks old. This indicates that early feed restriction level did not affect the water retention in flesh of carcass. Concerning the percentage of protein content of carcass, there were gradual increased ($P>0.05$) with increasing energy – protein restriction level. The insignificant increase in CP percentage of whole carcass with increasing feed restriction level may be due to the increase of muscles formation as a result of dietary treatments. Net protein accumulation in broiler meat could be accomplished by increasing protein synthesis, decreasing protein degradation or by combination of both (Doherty *et al.* 2004).

For ether extract percentage, the control group insignificantly recorded the highest value than the other groups. This higher fat content has been shown to accompanied with greater rate of fat deposition. These results are in agreement with those obtained by Lee and Leeson (2001) who found that carcass composition of chicks at 49 days of age was unchanged with early life mal nutrition. Zubair and Leeson (1996) reported that the feed restricted birds had lower percentage fat (not significantly) than the control group. Jones and Farrell (1992) found that carcass lipids, moisture, protein and ash contents of the birds were unaffected by the feed restriction when measured at 49 days of age.

It can be concluded that the effect of feed restriction on the lipid metabolism was more pronounced on the abdominal fat content (Table 2) but not on carcass lipids content.

**Table (3): The effect of different dietary treatments on carcass analysis of the experimental birds .**

| Items | Treatments | | | |
|---|---|---|---|---|
| | (1) 100% | (2) 90% | (3) 80% | (4) 70% |
| DM, % | 32.51 | 32.69 | 33.13 | 33.34 |
| | On DM basis | | | |
| Ether Extract, % | 27.51 | 26.64 | 26.20 | 25.61 |
| Crude protein % | 65.76 | 66.54 | 66.92 | 67.53 |
| Ash % | 6.78 | 6.88 | 6.94 | 6.92 |
| | On Fresh basis | | | |
| Ether Extract, % | 8.94 | 8.71 | 8.68 | 8.54 |
| Crude protein % | 21.38 | 21.75 | 22.17 | 22.51 |
| Ash % | 2.20 | 2.25 | 2.30 | 2.31 |

**Biochemical variables:**

Results of the biochemical variables in broiler chicks fed 100%, 90 %, 80% or 70% of starter recommended requirements are shown in Table (4). Serum total protein (TP), albumin (alb.) and globulin (glob.) exhibiting higher (P>0.05) values in broiler fed 80% restricted feed compared to control group. Chen *et al.* (2001) stated that levels of serum protein represent status of equilibrium in anabolic and catabolic reactions in protein metabolism in chickens.

**Table (4): Biochemical variables in broiler chicks at 7 weeks of age as affected by experimental diets.**

| Variables | Treatments | | | |
|---|---|---|---|---|
| | (1) 100% | (2) 90% | (3) 80% | (4) 70% |
| Total protein (g/dl) | 2.40 | 2.60 | 2.70 | 2.60 |
| Albumin (g/dl) | 0.95 | 0.99 | 1.05 | 0.97 |
| Globulin (g/dl) | 1.45 | 1.61 | 1.65 | 1.63 |
| A/G ratio | 0.66 | 0.62 | 0.64 | 0.60 |
| Uric acid (mg/dl) | 4.83 | 4.18 | 4.31 | 4.38 |
| Total cholesterol (mg/dl) | 126.30 | 123.00 | 118.70 | 114.00 |
| Triglycerides (mg/dl) | 82.40 | 76.30 | 74.70 | 64.00 |
| HDL (mg/dl) | 57.50 | 56.70 | 55.50 | 65.50 |
| LDL (mg/dl) | 52.30 | 51.07 | 48.20 | 46.90 |
| Glucose (mg/dl) | 201.30 | 194.00 | 206.70 | 207.50 |
| $T_3$ | 176.40 | 142.3 | 141.20 | 160.20 |
| $T_4$ | 39.30 | 40.90 | 35.50 | 40.30 |

So, the higher levels in the current study could be resulted from increased protein degradation for maintenance in restricted birds (katanbaf *et al.*, 1989). Thus, the subsequent decrease in (TP) value showed in 70% feed restricted group compared to control group may reflect the compensatory growth recorded in such birds. The increment in (glob.) values in restricted birds compared with the control group indicated that the experimental feed restriction did not affect the secondary immune responses of these birds. Since the highest values of globulin accompanied by the good immunity status of the birds (Abdel-Fattah *et al.*, 2003).

**Protein metabolites:**

Uric acid (UA) level did not significantly affected by feed restriction in this experiment .The similarity in serum uric acid concentration suggest that the rate of glomural filtiration and renal function adopted readily to feed intake and dietary protein (Mahagna and Nir, 1996). The higher (UA) reported in broiler fed 100% of starter requirements compared to feed restricted groups may be reflected the higher level of protein consumed in such birds since (UA) is the major end product of nitrogen metabolism in birds . In this respect, Hammoda *et al* (2001) demonstrated that, Plasma uric acid level were higher in broiler fed higher protein level than those fed low protein level.

**Lipid metabolites:**

Results of total cholesterol (TC), Triglycerids (TG) , high - density lipoprotein (HDL) and low - density lipoprotein (LDL) in broilers as affected by feed restriction are concomitant with those of body fat content and abdominal fat deposition recorded in the current study. It seemed that lipid metabolism is negatively but not significantly affected by feed restriction in broiler chicken. Serum total cholesterol (TC) recorded gradual insignificant lower values in restricted fed groups compared to those fed 100% of starter requirements. Razdan and Pettersson (1994a) elucidated that reduced cholesterol concentrations in restricted birds may indicate intestinal adaptation to fat absorption as well as changes in plasma Lipoprotein metabolism which may be attributed to increase binding of micelles. More recently, Baynes and Dominiczak (2005) stated that the rate of cholesterol endogenous synthesis is determined by dietary intake. For this reason, both dietary intake and biosynthesis are important in determining TC plasma concentration. The results are in complete agreement with those of Abdel-Fattah *et al.* (2003). Similar trend was also observed in serum Triglycerids (TG.). The decrement of TG level may prevent fatty acid release from adipose tissues or reducing fatty acid transport into the liver , hence inhibiting (TG) synthesis in the liver (Chen *et al.*, 2001). Hammoda *et al.* (2001) reported that plasma (TG) level is an accurate prediction of abdominal fatness and total lipid metabolism in broilers. It is possible to assume that higher level of protein consumed by control group compared to other experimental groups would facilitate inclusion of dietary fat into micelar from the gut lumen and thus increase absorption by the mucosa and rise plasma concentration of TG (Allen and Wong, 1993) .Similar trend was also observed for serum (LDL) and (HDL). The clear reduction in serum LDL ($P>0.05$) in restricted birds could be attributed to the reduction in the activity of lipoprotein lipase (the primary enzyme initiating lipid catabolism) in adipose tissue and increased the lipid deposition in the liver (Akiba *et al.*, 1982). Moreover, Razdan and pettersson (1994b) reported that the interruption of introhepatic circulation increases the hepatic bile acid synthesis from (TC), thus lowering the pool of plasma LDL. Since, changes in plasma (TC) mainifests mainly in LDL (Morgaret and Teitlebaum , 1994).

Baynes and Dominiczak (2005) reported that after absorption, cholesterol is transported to the liver in the form of chylomicrons which packages it into another lipoprotein VLDL which subsequently transforms into LDL that can deliver cholesterol to tissues.

On the other hand, several explanations have been given by Allen and Wong (1993) for the increased (LDL) induced herein in control group compared to restricted groups that , a reduction in the rate of removal of chylomicrons remnants probably due to saturation of serum lipoprotein lipase or VLDL production at the hepatic level in which there is a substitution of cholesterol esters for TG which may offer an explanation for increasing serum triglycerids in such birds and an appearance of HDL particle that floats at the density of VLDL.

**Blood Glucose:**

Serum glucose levels (Glu) were fluctuating, recording insignificant lower and higher values in birds fed 90% and 70% of starter requirement respectively compared to control group. The reduction in (Glu) value reported in the mild feed restriction group (90% of requirements) could be interpreted by Fujita and Yamamoto ( 1996) who reported that glucose and lipid metabolism is closely related to plasma catecholamine secretion. The mobilization of FFA from adipose tissue in response to energy demand under hypoglycemic conditions such as fasting should be stimulated by epinephrine. Moreover, Ozek and Bahtiyarca (2004) stated that the low blood (Glu) concentration can result from decreased its production as a result of decreasing feed intake or reduced the endogenous glycogenolysis or glucogensis or both.

On the other hand, the persistent increase in (Glu) levels reported in broilers fed 80% and 70% of starter requirements could be expected as a result of increasing corticosterone . Since, these levels of feed restriction could be considered as a potent physiological stressor in broiler, (Heck *et al.*, 2004).

**Thyroid hormones:**

Serum $T_3$ recorded higher value (P>0.05) in broilers of control group and subsequently, lowered in a more moderate feed restriction groups (90% and 80%, respectively). Then increased again in 70% of starter requirement group. While, $T_4$ concentration exhibited higher and lower insignificant levels in 90% and 80% groups, respectively. The discrepancies in $T_3$ and $T_4$ results could be physiologically interpreted as follows. The higher $T_3$ level observed in control group compared to other groups may reflect the higher lipid depositions recorded in those birds as a result of increased their hepatic lipogenesis and hepatic lipogenic enzymes which stimulated by a higher levels of $T_3$ in the circulation (Akiba *et al.*, 1982) . Moreover, Spencer *et al.* (1996) stated that $T_3$ level is closely associated with abdominal fat deposition in chickens. The increase in $T_3$ level reported in the control group is likely a result of a reduction in $T_3$ breakdown rather than a result of an increased conversion of $T_4$ to $T_3$ (as serum $T_4$ concentration did not increase) .

The insignificant reduction obtained in $T_3$ level in broilers fed 90% of starter requirement was accompanied by an increase in $T_4$ level in this group and may by due to a reduction in peripheral monodeiodination of $T_4$ (Newcombe *et al.*, 1992) . Otherwise, $T_3$ reduction reported in broiler fed 80% of starter requirement may be due to the decrease in the conversion of $T_4$ to $T_3$. Since, $T_4$ level recorded lower level in those birds compared to the others (Tomas *et al.*, 1986).

In general, $T_3$ reduction recorded in broilers fed a more moderate feed restriction may account for a lack of complete "Catch up" in growth shown in those birds (Newcombe *et al.* 1992) as shown by reducing their body weight. The transient increment recorded in $T_3$ level in broilers fed 70% of starter requirements may explain their compensatory growth rather than lower fat deposition. (Newcombe *et al.*, 1992) showed that , $T_3$ acts directly to stimulate cartilage growth and maturation by allowing other hormones e.g. growth hormone (GH) and or Somatomedin to act for protein deposition Moreover, Harden and Oscar (1993) reported that $T_3$ and GH act synergistically to reduce body fat content of broilers. Both of which alter the ability of (Glu) to stimulate lipolysis from avian adipose tissue. Therefore, the hormonal results suggested that the degree of feed restriction applied in this study was not severe because there was a very fast adaptive response with small and transient alterations in $T_3$ and $T_4$ concentration during the period of compensatory growth.

Finally, it could be concluded that the effect of feed restriction at an early age is more evident in lipid metabolism rather than protein metabolism, to obtain a better understanding of their nutritional and physiological responses.

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## صفات الذبيحة وبعض المتغيرات البيوكيميائية لكتاكيت اللحم المتــأثرة بالتحديــد الغذائي فى العمر المبكر .

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**قسم الإنتاج الحيواني – المركز القومي للبحوث – الدقي – القاهرة**

أجريت تجربة لتقدير صفات الذبيحة وبعض المتغيرات البيوكيميائية لكتاكيت اللحم المغذاة على علائــق تحتوى على ١٠٠% ، ٩٠ % ، ٨٠% ، ٧٠% من الاحتياجات الغذائية من كل من البروتين والطاقة القابلة للتمثيل ( عليقة البادئ) خلال فترة الأسبوع الثاني من العمر حيث تم استخدام ٧٢ كتكوت عمر يوم واحد فى أقفاص فردية . ووزعت على أربعة مجموعات كل منها تحتوى على ١٨ طائرا (١٨مكررا لكل مجموعة) . وقد أخذت قياسات الذبح وعينات الدم فى نهاية التجربة ( عند عمر ٤٩ يوما ) . وفيما يلي ملخصا لأهم مــا توصلت إليه هذه الدراسة من نتائج :

١- لم يتأثر كل من وزن الجسم والنسبة المئوية لكل من الذبيحة والكبد والقلب والقانــصة والكليــة بتعرض الطيور للتحديد الغذائي فى الفترة من ٨ – ١٤ يوما .

٢- انخفضت النسبة المئوية لدهن البطن معنويا بزيادة نسبة تحديد الغذاء .

٣- أعطت طيور المجموعات المحددة غذائيا نسبة أعلى (غير معنوية) من لحم الصدر عن مجموعة المقارنة .

٤- لم يختلف التحليل الكيماوي للذبيحة باختلاف المعاملات الغذائية .

٥- لم تختلف معنويا قيم البروتين الكلي والألبيومين والجلوبيولين ونسبة الالبيومين إلى الجلوبيــولين وحمض البوليك فى سيرم الدم بين المعاملات المختلفة .

٦- كانت مستويات الكوليستيرول الكلي والجلسريدات الثلاثية والبروتينات الدهنيــة عاليــة الكثافــة HDL وكذلك البروتينات الدهنية منخفضة الكثافة LDL فى سيرم الــدم متوافقــة مــع النتــائج المتحصل عليها بالنسبة لمحتوى الجسم من الدهن والنسبة المئوية لدهن البطن .

٧- كانت مستويات الجلوكوز وهرمونات الدرقية $T_3$ و $T_4$ فى سيرم دم الكتاكيت المغذاة على نظــم التحديد الغذائي المختلفة غير مستقرة وغير معنوية .