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EFFECT OF EARLY FEED RESTRICTION ON BROILER PERFORMANCE, BLOOD AND CARCASS PARAMETERS UNDER SUMMER CONDITIONS.

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SUMMARY

This research work was designed to study early feed restriction effects on broiler production during Egyptian summer. One hundred ninety eight unsexed Cobb-500 broiler chickens were divided to six experimental treatments with three equal replications. All chicks were free fed starter diet during the first week. In the second week, the chicks in the control group were fed the starter diet *ad libitum*, but feed intake of the other experimental groups were restricted at levels of 20, 25, 30, 35 and 40%, respectively from the feed intake of the control group. At 2 weeks of age, one bird from each replicate was sacrificed to obtain blood samples. All the experimental chicks were free fed basal grower diet from 14 to 42 days-old. Broiler performance was evaluated by live weight, feed consumed and feed conversion. Carcass parameters and some blood constituents were also measured. The current results showed that feed restriction improved the marketing live body weight, feed utilization and economical efficiency of treated broiler chicks, with no negative effect on either carcass traits or blood parameters. It could be concluded that early feed restriction during the second week of life up to 35% of *ad libitum* feeding can enhance the marketing weight and improve the feed conversion of broilers as compared to the control treatment under summer conditions in Egypt.

Keywords*: Broiler chickens, feed restriction and performance.*

INTRODUCTION

Poultry may respond differently to feed restriction (FR) during the post- FR period, thus resulted in a compensatory growth and reached the growth of unrestricted birds (Zhan *et al*., 2007). They found that restriction of broiler feed for 4 h/day throughout 1 to 21 day-old resulted in no statistical differences among the final body weight of the experimental groups at 63 days of age. Extensive studies in poultry, particularly in broiler chickens, demonstrated inconsistency in the compensatory growth due to strain and age of broilers, FR duration and severity of FR during the post-FR period (Butzen *et al*., 2015). In the literature, FR was reported to improve feed utilization and decrease the fat deposition and leg problems in broiler chickens (Attia *et al*., 1995). As feed-restricted for 4 or 6 days throughout starter time (from 7 to 21 day-old), broilers displayed similar growth at marketing age as compared to that of the control group (Netshipale *et al*., 2012). On the other hand, feed restriction of broilers has been reported to reduce ascites, sudden death and leg problems and metabolic diseases (Santoso, 2002 and Chenxi *et al*., 2017). In addition, timing of feed restriction reduced the initial growth but achieved an optimal growth performance in broilers (Butzen *et al*., 2013). This experiment was designed to evaluate early feed restriction effects on broiler performance during summer season in Egypt.

MATERIALS AND METHODS

This experiment was done at Fac. of Agric., Mans. Univ., throughout August and September, 2018. One hundred ninety eight unsexed Cobb-500 broiler chicks (with an average initial live body weight of 47.2±0.15 g) were randomly assigned to six experimental treatments of three replications each. All chicks were fed the starter diet *ad libitum* during the first week. In the second week, the chicks in the control group were fed *ad libitum* the starter diet, but feed intake of the other experimental groups was restricted at levels of 20, 25, 30, 35 and 40%, respectively form the feed intake of the control group. At 2 weeks of age, one bird from each replicate was sacrificed to obtain blood samples. All the experimental chicks were free fed basal grower diet from 14 to 42 day-old. Diet formulation was performed on the basis of the tabulated data of nutrient composition of feed ingredients published by the (NRC, 1994). Table 1 show feed ingredients and calculated analysis of the diets which used in this experiment.

Broiler performance was evaluated by live weight, feed consumption and conversion efficiency. The chicks were kept in battery cages. The means of minimum and maximum ambient temperature and relative humidity were recorded daily indoor at 12 p.m. and 12 a.m. and the average weekly values are given in Table 2. Throughout the experiment, average live weight, feed consumed and conversion efficiency were determined weekly on a replicate. The feed price/kg gain was evaluated. Feeding economic efficiency (EEF) was determined as following equation:

EEF = [(Sale price of one kg gain – Feed cost of one kg gain) / Feed cost of one kg gain] . Where 26 EGP is the price of one kg live weight of broiler chicks at the time of the experiment.

At 2 weeks of age (After feed restriction), one bird from each treatment was sacrificed to obtain blood samples. At 42-day-old, 3 birds/treatment were used to calculate carcass characteristics (percentages of carcass and edible organs). During slaughtering, heparinized blood samples were taken. Blood samples were centrifuged to obtain plasma. Plasma concentrations of total protein; Henry (1964), albumin; Doumas *et al*. (1971), triglycerides; Tietz (1995), cholesterol; Allain *et al*. (1974) and high density lipoprotein cholesterol (HDL-C; Sawle *et al*., 2002) were determined using diagnostic kits. Plasma concentration of low density lipoprotein-cholesterol (LDL-C) was also estimated according the following equation stated by Friedewald *et al.* (1972) :

LDL-C = Total Cholesterol–(HDL-C+VLDL); where VLDL are very low-density lipoprotein = plasma triglycerides/5. Plasma globulin was calculated as plasma total protein - plasma albumin.

Total antioxidant capacity (TAC) and malondialdehyde (MDA) were determined according to Koracevic *et al*. (2001) and Mihara & Uohiyama (1978), respectively. Plasma alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were estimated by diagnostic commercial kits (Reitman &Frankel, 1957). Corticosterone concentration in blood plasma was determined (Jezová *et al*., 1994). One-way analysis of variance using Statgraphics (Rockville, 1991) was used to analyze the obtained data. The significance level of 0.05 was used to consider the differences among treatments were significant (Duncan, 1955). The following statistical model was used: $Y_{ij} = \mu + F_i + e_{ij}$. Where: Y_{ij} = observed traits; μ = the overall mean; F_i = effect of feed restriction; e_{ij} = experimental random error.

Table (1): Components and calculated analyses of broiler experimental diets.

Components %	Starter	Grower
Yellow corn	64.5	70.7
Soybean meal (44%)	10.7	9.2
Dicalcium phosphate	1.8	1.8
Limestone	2.0	1.8
Corn gluten meal (60%)	19.8	15.5
Common salt	0.3	0.3
Vit. & min. Premix*	0.3	0.3
L-Lysine HCl	0.6	0.4
Total	100	100
Air-dried calculated analysis**		
Metabolizable energy Kcal/Kg	3157	3165
Crude protein %	23.03	20.04
EE %	3.3	3.15
CF %	2.43	2.40
Ca %	1.18	1.10
P %	0.69	0.67
Av. P %	0.44	0.44
Lysine%	1.13	0.90
Methionine%	0.48	0.41
Methionine+Cystine%	0.88	0.77
EGP/kg diet	6.0	6.0

** Each 3 kg premix contains: Vit. A,12,000,000 IU; Vit. D_3 2,500,000 IU; Vit. E,10 g; Vit. K,2.5 g; Vit. B_2,5g; Vit. B_6,1.5g; Vit. B_{12},10mg; Biotin,50mg; Folic acid,1.0g; Nicotinic acid,30mg; Pantothenic acid,10g; Antioxidant,10g; Mn,60g; Cu,10g; Zn,55g; Fe,35g; I, 1.0g; Co,250mg and Se,150mg.*

*** Calculated according to NRC (1994).*

Table (2): Ambient temperature (AT) and relative humidity (RH) throughout the experimental period.

Experimental	AT, °C		RH, %	
weeks	Minimum	Maximum	Minimum	Maximum
1	30.0	36.4	50.3	81.0
2	28.3	36.9	50.0	85.0
3	28.0	35.6	54.3	82.9
4	25.6	34.4	55.7	80.7
5	26.7	35.9	52.1	80.7
6	26.0	34.3	57.1	83.6

RESULTS AND DISCUSSION

Live body weight:

Table (3) shows the effect of quantitative feed restriction (FR) on the weekly body weight of Cobb500 broiler chicks. Live body weight of chicks was not affected by feed restriction in the first and fourth weeks of the experimental period. Significant differences were detected among the different treatments in bird's weight in the second, third, fifth and sixth week-old. At the second week of study, the feed restricted groups (T2, T3, T4 and T5) recorded significantly lower live body weights compared with the control group. At the third week of experiment, live body weights of the experimental groups subjected to 30 or 35% FR were not significantly different from the control chicks; however, the other groups (20, 25 or 40% FR) had significantly lower live body weights. At the fifth week of experiment, birds subjected to 30% FR displayed significantly higher live body weight compared with other experimental groups. Feed restriction at levels of 20, 25, 30 and 35% led to a significant improvement in live body weights of chicks at the sixth week of study compared with other experimental groups.

Our results agree with those of Gous and Cherry (2004), who found that early feed restriction caused a rapid growth in broiler chicks. The positive effect of FR on growth rate of chickens may be an improvement in the efficiency of feed utilization by birds (Lippens *et al*., 2000). In addition, Morais *et al*. (2017) found that feed restriction had improved the final body weight due to improvement in feed conversion. Teimouri *et al*. (2005) reported that levels of dietary dilution from 8 to 14 day-old positively affect broilers weight. Attia *et al*. (2017) found that feed restriction produced a compensatory growth in broiler chickens throughout the period from 15 to 35 days of age. Chenxi *et al*. (2017) found that body weight of restricted broilers was higher than the control counterparts.

On the contrary, Mahmood *et al*. (2007) illustrated that the broiler chickens reared under feed restriction for 3, 5 and 7 hours daily from the 8th to 28th day had lighter body weights than those reared under free feeding. Similarly, Njoku *et al*. (2012) reported that feed-restricted birds gained less weight than fully-fed birds.

Table (3): Effects of feed restriction on weekly body weight of broiler chicks.

Treatment	Age in week						
	Initial wt, (g)	1	2	3	4	5	6
T1	47.1	132	275^{a}	561^{a}	915	1300^{bc}	1833^{c}
T2	47.3	130	236^{bc}	527^{b}	897	1347^{ab}	1916^{ab}
T3	46.5	130	245^{b}	522^{b}	877	1295^{bc}	1899^{ab}
T4	47.3	132	236^{bc}	549^{ab}	953	1390^{a}	1981^{a}
T5	47.4	134	227^{c}	532^{ab}	880	1315^{bc}	1915^{ab}
T6	47.6	133	203^{d}	486^{c}	843	1265^{c}	1874^{bc}
SEM	0.36	2.55	5.24	10.4	27.04	23.13	25.88
Significance	NS	NS	**	**	NS	*	*

a-c: Means within column with different superscripts are significantly different .

*SEM = Standard error of the means; NS=Not significant; *=Significant at P≤0.05; **= Significant at P≤0.01*

Weight gain:

Table (4) shows no differences among treatments of chicks in daily gain throughout the 1st, 3rd, 4th, and 6th weeks-old. Significant differences were found among the experimental broilers throughout the 2nd and 5th weeks of age and total experimental period (1-6 weeks of age). During 2nd week of study, *ad libitum* feeding (T1) caused significantly higher (P≤0.01) daily body weight gain than the other experimental groups. Feed restriction had a beneficial effect on daily weight gain of chicks in the fifth week of study compared with *ad libitum* feeding (the control group). During the whole experimental period, feed restriction at levels of 20, 30 and 35% led to a positive effect in daily gain of chicks comparing with other experimental groups suggesting that growth compensation occurred. In this connection, Zubair and Leeson (1996) indicated that decreasing live body weight during early feed restriction in chickens could be recovered by compensatory growth during 20-25 days after re-feeding period.

In agreement with the obtained results, Butzen *et al*. (2013) showed that feed restriction had a compensatory growth in broiler chickens. Cristiano *et al*. (2013) reported that increasing levels of feed restriction up to 40% reduced body weight gain on broiler chickens. In addition, Omosebi *et al*. (2014) found that broiler chickens kept under feed restriction (40 % for 6 weeks) had superior feed gain ratio compared with the control group. Kouki and Bergaoui (2016) found that broilers chickens reared under restricted feeding from 35 to 49 days of age had significantly higher weight gain during the re-feeding period comparing to the control.

On the contrary, David and Subalini (2015) revealed that feed restriction (3, 5 and 7 hours daily) did not significantly affect body weight gains of broiler chickens. Similarly, Chodová and Tůmová (2017) found that feed restriction (65-80%) had no significant effect on daily body weight gain of broilers.

Table (4): Daily gain (g) of broiler chicks as affected by feed restriction.

Treatment	Week of study						
	1	2	3	4	5	6	1-6
T1	12.08	26.71^{a}	36.86	50.64	55.00^{c}	76.19	42.53^{c}
T2	11.80	14.94^{b}	38.19	52.88	64.29^{a}	81.33	44.49^{ab}
T3	11.88	16.49^{b}	36.07	50.67	59.76^{b}	86.33	44.11^{bc}
T4	12.08	15.06^{b}	41.29	57.76	62.38^{ab}	84.46	46.05^{a}
T5	12.40	13.46^{b}	40.29	49.71	62.14^{ab}	85.76	44.47^{ab}
T6	12.19	9.91^{b}	37.55	51.02	60.24^{ab}	86.95	43.48^{bc}
SEM	0.37	2.38	1.34	3.09	1.36	2.96	0.62
Significance	NS	**	NS	NS	**	NS	*

a-c: Means within column with different superscripts are significantly different .

*SEM = Standard error of the means; NS=Not significant; *=Significant at P≤0.05; **= Significant at P≤0.01*

Feed intake:

Data of Table (5) show daily feed intake of Cobb500 broiler chicks reared under feed restriction. Feed restriction had a significant effect on feed consumption throughout the 2nd and 5th weeks-old and total experimental period (1-6 weeks of age). Feed restriction had no effect on daily feed intake of broilers during of 1st, 3rd, 4th and 6th week-old. The control birds had significantly higher daily feed intake than the other experimental groups at the second week of age. At the 5th week of age, chicks subjected to 20% FR consumed significantly more feed than that of the control birds but other groups were not significantly different from the control. During the total experimental period, daily feed intake of chicks subjected to 40% FR was significantly lower than that of the control birds.

In agreement with the present results, Hassanien (2011) reported that birds kept under higher levels of feed restriction consumed a little feed. Omosebi *et al*. (2014) found that broiler reared under restriction (40 % for 6 weeks) had significantly reduced feed intake. Adeyemi *et al*. (2015) reported that broiler chicks kept under feed restricted (80-75%) decreased daily feed intake.

However, Khetani *et al*. (2009) illustrated that feed restricted broilers led to an increase in feed intake. Also, Lanhui *et al*. (2011) found a higher feed consumption by control birds compared to feed-restricted groups. Jahanpour *et al*. (2013) reported that broiler exposed to early feed restriction had an increased feed intake. Attia *et al*. (2017) found that feed restriction during the 7-14 d of age consumed feed without significant differences in feed intake. Novele *et al*. (2008) reported that feed intake was significantly reduced by feed restriction.

Table (5): Effects of feed restriction on daily feed intake of broiler chicks.

Treatment	Week of study						
	1	2	3	4	5	6	1-6
T1	17.84	41.82^{a}	78.52	96.19	115.6^{bcd}	146.5	82.74^{a}
T2	16.86	32.35^{b}	71.38	100.90	125.7^{a}	150.4	82.94^{a}
T3	17.71	30.36^{c}	69.60	100.45	114.8^{cd}	146.2	79.85^{ab}
T4	17.19	28.35^{d}	75.21	102.95	121.4^{abc}	150.4	82.59^{a}
T5	16.86	26.30^{e}	71.50	96.67	122.1^{ab}	147.8	80.21^{ab}
T6	16.82	24.27^{f}	70.60	95.48	114.0^{d}	147.3	78.09^{b}
SEM	0.82	0.37	2.86	2.69	0.23	2.03	1.09
Significance	NS	**	NS	NS	*	NS	*

a-d: Means within column with different superscripts are significantly different .

*SEM = Standard error of the means; NS=Not significant; *=Significant at P≤0.05; **= Significant at P≤0.01*

Feed conversion ratio and economical efficiency:

Table (6) shows feed restriction effects on feed conversion of Cobb500 broiler chicks. The feed restriction of broiler chicks did not affect feed conversion ratio during the 1st, 2nd, 3rd, 4th, 5th and 6th weeks of age. However, there was a significant effect of feed restriction on feed conversion of broiler chickens during total experimental period (1-6 weeks of age). Feed restriction at levels of 20, 25, 30, 35 or 40% led to a significant improvement in feed conversion ratio and economical efficiency of feeding of chicks during the entire experimental period comparing to the control. The broiler feed conversion improvement may be due to decreased feed intake and increased growth (Hassanien *et al*., 2013)

Regarding to our results, Mahmood *et al*. (2007) and Onbasilar *et al*. (2009) reported that broilers kept under feed restriction had an improvement in feed utilization. Similarly, Mehmood *et al*. (2013) found that feed restriction improved feed conversion ratio in broiler chickens. In addition, Omosebi *et al*. (2014) found that broilers reared under feed restriction (40 % for 6 weeks) had improved feed conversion ratio. Furthermore, Adeyemi *et al*. (2015) found that feed restriction (30%) improved feed conversion ratio of broiler chicks. Additionally, Afsharmanesh *et al*. (2016) found that feed restriction (50% of *ad libitum* feed between 6 to 12 days of age) significantly improved feed conversion ratio compared with group fed free during the starter period (1 to 21 day-old). Chenxi *et al*. (2017) reported that feed conversion of the feed restricted group (10% of energy and protein from 8 to 14 day-old) was significantly better than the control. Similar findings were obtained by Kouki and Bergaoui (2016), who found that broiler chickens exposed to feed restriction had superior feed conversion ratio during the re-feeding period compared to that of the *ad libitum*-fed group.

However, David and Subalini (2015) revealed that feed restriction (3, 5 and 7 hours daily) did not affect feed conversion of broiler chicks. Chodová and Tůmová (2017) found that feed restriction (65-80%) did not affect feed conversion of broilers.

Our results agree with those of David and Subalini (2015), who found that feed restriction of broiler improved the economical efficiency of broiler chickens.

Table (6): Effects of feed restriction on feed conversion ratio and economical efficiency of feeding (EEF) for broilers.

Treatment	Week of study							EEF
	1	2	3	4	5	6	1-6	
T1	1.48	1.70	2.14	1.91	2.10	1.93	1.95[a]	1.227[c]
T2	1.43	2.17	1.87	1.91	1.96	1.85	1.86[b]	1.326[b]
T3	1.50	1.84	1.93	1.98	1.92	1.69	1.81[c]	1.394[a]
T4	1.43	1.88	1.83	1.78	1.95	1.78	1.79[c]	1.416[a]
T5	1.36	1.97	1.78	2.02	1.97	1.73	1.80[c]	1.403[a]
T6	1.38	2.55	1.89	1.88	1.89	1.70	1.80[c]	1.413[a]
SEM	0.08	0.21	0.09	0.14	0.05	0.06	0.02	0.0212
Significance	NS	NS	NS	NS	NS	NS	**	**

a-c: Means within column with different superscripts are significantly different .

*SEM = Standard error of the means; NS=Not significant; *=Significant at P≤0.05; **= Significant at P≤0.01*

Blood parameters:

Blood plasma parameters of Cobb500 broiler chickens at two and six weeks-old are shown in Table (7). No significant differences were found in plasma concentration of total protein, albumin, globulin, triglycerides, cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (vLDL), total antioxidant capacity (TAC) and malondialdehyde (MDA). Also, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were not affected by feed restriction at 2 or 6 weeks of age. There were significantly increase in plasma levels of corticosterone due to feed restriction. The high levels of corticosterone were recorded with the high levels of feed restriction percent (30, 35 and 40% from free feeding) comparing to their control.

In agreement with our results, Kumar *et al*. (2015) reported that feed regimen had no negative effect on activity of liver enzymes (AST and ALT) or protein metabolism at 14 (end of restriction period) and 35 days of age. Similarly, Adeyemi *et al*. (2015) found that serum concentrations of total protein, albumin and globulin were not affected by 15 or 30% feed restriction. Afsharmanesh *et al*. (2016) found that blood levels of total cholesterol, HDL, LDL and triglycerides of broilers were not influenced by feed restriction at a level of 50% from day 6 to day 12. Chenxi *et al*. (2017) reported that feed restriction had no effect on the plasma total protein, albumin or globulin of broilers.

On the other hand, Nassef *et al*., (2015) found that, broilers subjected to feed restriction by 20% from 7 to 21 days had significantly low blood content of triglycerides, but the blood concentration of cholesterol, HDL, vLDL, ALT, AST, total protein, albumin and globulin were not differ from the control group. Jahanpour *et al*. (2015) found that feed restriction (4 h per day from 7 to 21 days of age) significantly increased plasma concentration of albumin but decreased plasma levels of cholesterol, glucose and triglyceride of broilers. In addition, Attia *et al*. (2017) found that feed restriction significantly increased plasma albumin but decreased total cholesterol while plasma levels of total protein, globulin, total antioxidant capacity (TAC) and malondialdehyde (MDA) were not affected. Increased corticosterone concentration in broiler plasma may be depend on condition of stress and the metabolic effect of feed restriction, as corticosterone is involved in regulation of blood glucose levels (Hoching *et al*., 1996; De Jong *et al*., 2002 and Mench, 2002).

Table (7): Feed restriction effects on blood plasma constituents of broiler chickens at 2 and 6 weeks of age.

At two weeks old	Treatment							
	T1	T2	T3	T4	T5	T6	SEM	SL
Total protein g/dl	4.37	4.25	4.74	4.87	4.67	5.02	0.20	NS
Albumin g/dl	2.32	2.32	2.53	2.63	2.57	2.68	0.10	NS
Globulin g/dl	2.06	1.93	2.20	2.24	2.10	2.35	0.12	NS
Cholesterol mg/dl	141.7	147.2	138.3	153.5	153.5	140.7	6.96	NS
Triglycerides mg/dl	117.1	119.9	120.1	122.4	117.1	108.8	5.34	NS
HDL mg/dl	38.6	44.5	44.3	45.9	44.1	46.0	4.86	NS
vLDL mg/dl	23.4	24.0	24.0	24.5	23.4	21.8	1.07	NS
LDL mg/dl	79.8	78.7	69.9	83.2	85.9	73.0	6.01	NS
AST U/l	63.6	51.8	62.0	74.8	70.4	75.1	6.05	NS
ALT U/l	17.3	18.5	19	21.1	17.4	17.9	1.37	NS
TAC mM/ml	1.21	1.28	1.14	1.26	1.10	1.11	0.06	NS
MDA nmol/ml	19.8	17.7	19.7	22.5	21.2	23.6	1.42	NS
Corticosterone nm/dl	1.23^{c}	1.42^{bc}	1.93^{bc}	2.19^{b}	3.45^{a}	3.54^{a}	0.25	**
At six weeks old								
Total protein g/dl	3.92	4.35	4.23	4.33	4.31	4.28	0.25	NS
Albumin g/dl	2.04	2.17	2.31	2.17	2.22	2.19	0.12	NS
Globulin g/dl	1.88	2.18	1.92	2.16	2.09	2.09	0.14	NS
Cholesterol mg/dl	177.1	164.6	165.0	155.4	161.7	156.0	8.03	NS
Triglycerides mg/dl	130.8	117.5	120.8	120.6	134.2	123.3	5.41	NS
HDL mg/dl	61.7	55.2	56.7	58.1	55.7	50.9	4.39	NS
vLDL mg/dl	26.2	23.5	24.2	24.1	26.8	24.7	1.08	NS
LDL mg/dl	89.3	85.9	84.1	73.2	79.2	80.5	7.93	NS
AST U/l	83.8	77.4	79.3	76.3	86.0	72.1	4.93	NS
ALT U/l	19.2	18.4	21.4	20.6	23.5	22.9	1.48	NS
TAC mM/ml	1.41	1.34	1.53	1.43	1.39	1.19	0.12	NS
MDA nmol/ml	22.3	27.2	26.7	32.2	29.5	31.6	2.13	NS
Corticosterone nm/dl	3.63c	4.38^{ab}	4.11^{bc}	4.54^{ab}	4.88^{a}	4.96^{a}	0.22	**

a-c: Means within column with different superscripts are significantly different .

*SEM = Standard error of the means; NS=Not significant; *=Significant at P≤0.05; **= Significant at P≤0.01*

Carcass parameters:

In Table (8), carcass parameters of Cobb500 broiler chicks at 6 week-old as affected by feed restriction. Carcass traits were not significantly affected by feed restriction. Feed restriction did not affect relative weights of carcass traits, total edible parts (TEP) or inedible parts (IEP) of broiler chickens.

Our results agree with those of Cristiano *et al*. (2013) who found that carcass and breast percentage were not affected by feed restriction of broilers. Similar results were found by David and Subalini (2015) who reported that feed restriction (3, 5 and 7 hours daily) had no effect on carcass characteristics of broiler chickens. Furthermore, Kouki and Bergaoui (2016) reported that carcass yield of chicken was not affected by feed restriction when compared with *ad libitum*-fed group. Recently, Saber (2016) found that carcass traits of feed restricted broilers were not significantly affected.

In disagreement with the obtained results, Tumova *et al*. (2002) mentioned that broiler carcass weight was increased in response to feed restriction. Saleh *et al*. (2005) found that feed restriction significantly reduced carcass percent of broilers. In addition, Onbasilar *et al*. (2009) reported that broiler reared under feed restriction had significantly lower heart weight compared with those fed control diet. Similarly, Boostani *et al*. (2010) found that the feed restriction reduced weights of breast and abdominal fat of broiler chicks as comparing to the control. Jalal and Zakaria (2012) reported that broiler chickens kept under feed restriction exhibited significant differences in dressing percentage when compared with chicks fed *ad libitum*. Additionally, Mirshamsollahi (2013) reported that chickens reared under feed restriction displayed significantly higher carcass weight and lower abdominal fat pad weight as compared to the control group.

Table (8): Feed restriction effects on carcass traits of 42-day-old broilers.

Treatment	LBW (g)	Carcass %	Liver %	Gizzard %	Heart %	Giblets %	TEP %	IEP %
T1	2000	71.6	1.71	1.46	0.47	3.64	75.21	24.79
T2	1997	72.6	1.82	1.72	0.51	4.05	76.67	23.33
T3	2043	73.4	1.82	1.76	0.48	4.05	77.43	22.57
T4	2068	71.8	1.95	1.62	0.49	4.06	75.85	24.15
T5	2051	72.5	1.81	1.67	0.48	3.96	76.48	23.52
T6	2040	73.7	1.88	1.79	0.48	4.15	77.88	22.12
SEM	41.2	1.36	0.08	0.08	0.02	0.12	1.35	1.35
Significance	NS	NS	NS	NS	NS	NS	NS	NS

TEP: Total edible parts, IEP: Inedible parts.

NS=Not significant

CONCLUSION

It could be concluded that early feed restriction during the second week of life up to 35% of *ad libitum* feeding can enhance the marketing weight and improve the feed conversion and economical efficiency of broiler chickens comparing with their control under summer conditions in Egypt.

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تأثير تحديد الغذاء المبكر على الأداء الانتاجى ومقاييس الدم وصفات الذبيحة لدجاج اللحم تحت ظروف الصيف

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أجريت هذه الدراسة لتقييم تأثير تحديد الغذاء المبكر على أداء دجاج اللحم خلال فصل الصيف فى مصر. تم استخدام مائة ثمانية وتسعون من كتاكيت اللحم سلالة Cobb- 500 غير المجنسة وتم توزيعها عشوائيا لستة معاملات تجريبية كل منها فى ثلاث مكررات. تم تغذية جميع الكتاكيت بحرية على العليقة البادئ فى الأسبوع الأول. في الأسبوع الثاني تم تغذية الكتاكيت في المجموعة الكنترول على العليقة البادئ بحرية، بينما غذيت بقية المجموعات التجريبية الأخرى على العليقة المحدده بمستويات 20 ، 25 ، 30 ، 35 و 40٪ ، على التوالي من المأكول بواسطة المجموعة الكنترول.عند عمر اسبوعين، تم ذبح طائر واحد من كل مكررة بالمعاملة للحصول على عينات الدم. تم تغذية جميع الكتاكيت التجريبية بحرية على العليقة النامية من 14 إلى 42 يوم من العمر. تم تقييم الأداء الإنتاجى لدجاج اللحم من مواصفات خلال وزن الجسم الحي ، والمأكول من العلف ومعامل التحويل الغذائى. كما تم قياس الذبيحة وبعض مقاييس الدم فى نهاية التجربة.

أظهرت النتائج الحالية أن تحديد الغذاء أدى إلى تحسين وزن الجسم الحي التسويقى ، ومعامل التحويل الغذائى ، والكفاءة الاقتصادية لدجاج اللحم ، مع عدم وجود تأثير سلبي على مواصفات الذبيحة ومقايس الدم. يمكن استنتاج أن تحديد الغذاء المبكر خلال الأسبوع الثاني من العمر بنسبة تصل إلى 35٪ من المأكول بحرية يمكن أن يحسن الوزن التسويقي ويحسن معامل التحويل الغذائى لدجاج اللحم مقارنة بالمجموعة الكنترول تحت ظروف الصيف في مصر.