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EFFECT OF DAILY FEEDING TIME RESTRICTION ON BROILER CHICKEN PERFORMANCE UNDER SUMMER SEASON CONDITIONS OF UPPER EGYPT

By

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Abstract: *A total number of one hundred and fifty of one-day old brown shaver broilers chicks were used to study the effect of daily feeding time restriction on broiler chicken performance and mortality rate under summer season condition of Upper Egypt. The chicks were randomly divided into 5 experimental groups, (control and 4 treatments). Each group included three replicates of 10 chicks. Group 1 (FFC) was used as control in which the birds were fed ad libitum from 1 to 49 days of age. In groups 2 (EFR6) and 3 (EFR9), the feed was removed for 6 or 9 hours per day from 2 to 4 weeks of age, respectively. In groups 4 (LFR6) and 5 (LFR9), the feed was removed for 6 or 9 hours per day from 5 to 7 weeks of age, respectively. The birds were subjected to heat stress during the experiment since the temperature ranged between 26 and 38 °C. The obtained results could be summarized as follows:*

At 7 weeks of age, broilers of EFR6 group had significantly (P≤0.05) higher body weight (BW) than those of FFC, EFR9 and LFR9 groups, while the broilers of LFR6 group had an intermediate BW. Also, the broilers of EFR6 group showed a significantly higher (P≤0.05) daily weight gain than those of FFC, EFR9 and LFR9 groups, but not than those of LFR6 group. Time of feed restriction had no effect on the overall mean of feed consumption (FC) and in cumulative feed conversion ratio (FCR) among all groups, however birds in LFR-6H, EFR6 and EFR9 groups had better cumulative FCR by about 5.4, 3.6 and 2.3 %, respectively than that of FFC group. The broilers of all restricted fed groups had fewer deaths than their controls, while the mortality rate was 13.3, 0.00, 6.70, 0.00 and 6.70% for FFC, EFR6, EFR9, LFR6 and LFR9 groups, respectively.

Broilers of EFR6 and EFR9 groups had significantly heavier (P≤0.05) carcass weight compared to those of FFC, LFR6 and LFR9 groups. It was found that the birds of EFR9 had significantly heavier breast (P≤0.05) percentage than those of LFR6 and LFR9, while FFC and EFR6 groups had an intermediate percentages. The broilers of EFR6 had

significantly lower (P≤0.05) percentage of liver than those of FFC and LFR9; gizzard and giblets than those of FFC, LFR6 and LFR9, but there are significant (P≤0.05) differences in the fat percentages of abdominal, subcutaneous, neck and total of those groups. The EFR6 and EFR9 groups had insignificantly lower percentage of total fat by about 21.1 and 19.9%, respectively than that of FFC group. Time of feed restriction at different ages had no significant effect on the percentage of other carcass (yield and parts) and body organs weight.

All restricted fed groups (EFR6, EFR9, LFR6 and LFR9) showed increased economical efficiency by 70, 36, 85 and 28%, respectively as compared with FFC one.

It could be concluded that, the most suitable and economically efficient feeding program during high environmental temperature was feed restriction for 6 hours per day (from 9 a.m. to 3 p.m.) from 5 to 7 weeks of age.

INTRODUCTION

Ambient temperature is the most environmental factor, which affects all physiological processes and productive performance of animal. Heat-stressed broiler chicken showed reduction in performance, decrease in feed intake, slow growth rate and higher mortality (van Kampen, 1982). While, Zulkifli *et al.,* (1994) reported that heat stress depressed immune function in fowls.

A common management practice is to withdraw feed during the heat stress. When feed is withdrawn for short terms it can reduces the bird's body temperature and increase its ability to survive acute heat stress. Fasting for intervals of three to six hours prior to heat stress (between 35-37 °C) and totaling up to 12 hours significantly (P≤0.05) reduces mortality (Raghavan, 2003).

Early feed restriction or feed removal with compensatory growth is frequently used to decrease the incidence of leg problems, ascites (Deaton, 1995) and reduced mortality (Mollison *et al.,* 1984). Vo *et al.,* (1998) reported that feed restriction to 70% of full-fed control for 2 weeks significantly (P≤0.05) reduced weight gain. Earlier studies (Arce *et al.,* 1986; Plavnik *et al.,* 1986) have shown that broiler chicken subjected to early feed restriction utilized their feed with more efficiency and accumulated less abdominal fat compared to broilers fed *ad libitum*. Summers *et al.,* (1990) could not show an advantage in terms of abdominal fat for broilers with restricted feeding from 7 to 14 days of age when compared with those ate *ad libitum*. Fontana *et al.,* (1993) found that no significant (P≤0.05) differences for weights of abdominal fat pad, gizzard and liver between early restricted birds and *ad libitum* ones at 49 days of age.

Heat stress is the major problem that usually faces poultry as well as poultry farmers in summer months. Heat stress is an abnormal condition caused by hot and humid conditions and is usually regulated by the control of environmental factors such as house temperature and ventilation. Since, sophisticated housing designs cannot always be accommodated because of financial considerations, therefore alternate strategies need to be considered. In recent years feed restriction during high temperature has been identified which can help in alleviation the effects of heat stress in poultry. Therefore, the objective of this study was to determine the effect of time of feed restriction at different ages summer season conditions on broiler chickens performance and mortality rate in Upper Egypt.

MATERAILS AND METHODS

The present work was carried out at the Research Poultry Farm of Animal and Poultry Production Department, Faculty of Agriculture, Assiut University, Assiut Egypt from 21st of July to 7th of September 2004. One hundred and fifty of one-day old brown Shaver broilers chicks were used in this study. All chicks were wing banded, individually weighed, and randomly distributed into 5 experimental groups, (control and 4 treatments). Each group included three replicates of 10 chicks each. The birds were housed in floor pens where each replicate was kept in a partition of 2 square meters provided with litter of wheat straw (3 cm depth). The five experimental groups were as follows: Birds in group 1 (control) which fed *ad libitum* from 1 to 49 days of age (FFC). In groups 2 and 3 (EFR6 and EFR9) where the feed was removed for 6 hours per day (from 9 a.m. to 3 p.m.) and 9 hours per day (from 9 a.m. to 6 p.m.), respectively from 2 to 4 weeks of age. In groups 4 and 5 (LFR6 and LFR9) where the feed was removed for 6 hours per day (from 9 a.m. to 3 p.m.) and 9 hours per day (from 9 a.m. to 6 p.m.), respectively from 5 to 7 weeks of age. The chicks were maintained under continuous lighting with water available all the time. The birds received starter diet till two weeks of age; grower diet from three to five weeks of age; and finisher diet from six to seven weeks of age. The composition and proximate analysis of the experimental diets are shown in Table 1. Both groups were kept at 50-60% relative humidity. The indoor temperature was daily recorded every 3 hours during the experimental period and then the average minimum and maximum indoor temperature was weekly calculated as shown in Table 2. The following parameters were studied:

Body weight (BW) and feed consumption (FC): Birds of each replicate were individually weighed every week and FC of each replicate was also weekly calculated.

Feed conversion ratio (FCR): Mean FCR was weekly calculated by dividing total feed consumed in a pen by the total weight gain of its birds.

Carcass criteria: At 49 days old, 6 birds per treatment were chosen around the average weight of the group and sacrificed. After slaughtering, the internal organs were removed from the body where the heart, liver, empty gizzard, proventriculus and spleen were weighed. The empty gastrointestinal tract including the pancreas was weighed. Each of head was at the occipital bone, feet and shanks at the hock joints, wings at shoulder joints, neck close to the shoulder were removed and then all parts were individually weighed. Breast, femurs and drumsticks were weighed as separate carcass parts. The back was separated from breast along the vertebral column, then breast included the bones of sternum was weighed.

Carcass yield and carcass parts (carcass weight, blood, feet & shank, head, neck, drumsticks, femurs, drumsticks & femurs, breast, wings, back and skin) were calculated as percentage of pre-slaughter live body weight, while body organs (heart, liver, gizzard, giblets, proventriculus, spleen, gallbladder and intestine) were calculated as percentage of carcass weight. The fat contents were calculated as percentage of carcass weight therefore, abdominal, gizzard, neck, drumsticks & femurs, heart, breast and subcutaneous fats were removed and weighed.

Mortality rate (MR): Number of dead birds was daily recorded, and MR was calculated for each treatment.

Economical efficiency (EE): Feed cost per bird (starter, grower and finisher diets) was calculated by multiplying mean FC per bird by the cost of 1 kg of diet. Bird price was calculated by multiplying mean bird weight by price of 1 kg of live weight. Depreciation costs were calculated by multiplying bird price by mortality rate. Net revenue was calculated by subtracting bird price from total feed and depreciation costs. Economic efficiency (EE) was estimated by dividing net revenue by total feed and depreciation costs.

Statistical analysis: Data collected were subjected to ANOVA by applying the General Linear Models Procedure of SAS software (SAS institute, version 6.12, 1996). Duncan (1955) was used to detect differences among means of different treatments.

RESULTS AND DISCUSSION

1- Body weight (BW):

There were no significant differences in BW among all restricted fed groups and FFC one from day-old to 3 weeks of age (Table 4). At 4 weeks of age, the broilers of EFR6 group had significantly higher ($P \leq 0.05$) BW

than those of FFC, EFR9 and LFR9 groups, while the broilers of LFR6 had an intermediate value. At 5 weeks of age, the broilers of EFR6 and LFR6 groups had significantly higher BW ($P \leq 0.05$) than those of FFC and EFR9, while the birds of LFR9 had an intermediate estimate. At 6 weeks of age, the boilers of EFR6 group had significantly higher BW ($P \leq 0.05$) than those of FFC and EFR9 groups, while the birds of LFR6 and LFR9 had similar BW. At 7 weeks of age, broilers of EFR6 had significantly higher ($P \leq 0.05$) BW than those of FFC, EFR9 and LFR9 groups, while an intermediate value was for broilers of LFR6.

Zubair and Leeson, (1994) recommended that feed restriction start in broilers at approximately 6 days of age which usually allows for full recovery of body weight at 49 days of age. Similarly, Plavnik *et al.,* (1986) and Jones and Farrell, (1992a) have shown that full compensatory growth can be achieved within shorter times enabling broilers to reach market weight at earlier ages. Washburn and Bondari (1978) initiated feed restriction after 3 weeks of age and found little evidence of compensatory growth likely because insufficient time was allowed for recovery. Similar results were found by Arafa *et al.,* (1983) who restricted broilers in the final stages of production (5-8 weeks of age). Nitsan *et al.,* (1991), and O'Sullivan *et al.,* (1991) showed that restricting the feeding time to 16 hours per day from 8 to 21 days of age resulted in decreased body weights and poorer feed conversion at 28 days. However, at 49 days of age, body weights, monetary returns, and feed conversion were improved as compared to the unlimited (Full) feeding program. It was postulated that the feed restriction caused an enlarged digestive system which might facilitate an improved growth rate when the broilers are returned to a full feeding program.

2. Body weight gain (BWG):

No significant differences in BWG were detected among all groups at 2 and 6 weeks of age (Table 4). The broilers of EFR6 group gained significantly more ($P \leq 0.05$) weight than those of FFC and LFR9 groups at 4 and 7 weeks of age, but the broilers of EFR9 and LFR6 had an intermediate estimate. At 4 weeks of age, the birds of EFR6 and LFR6 groups gained significantly more ($P \leq 0.05$) weight than those of FFC and LFR9 groups, but EFR9 group had an intermediate BWG. At 5 weeks of age, no significant differences in BWG were found among FFC, EFR6 and LFR9 groups, however, the birds of LFR6 gained significantly more ($P \leq 0.05$) weight than those of EFR9 group. Nevertheless, the overall mean indicates that the broilers of EFR-6 group showed a significantly higher ($P \leq 0.05$) daily weight gain than those of FFC, EFR9 and LFR9 groups, but not more than LFR6 group. These results are in agreement with those of Plavnik and Hurwitz (1989) who reported that the use of early feed restriction improved weight

gain. Also, the same authors suggested that the essential amino acid requirements were high in order to maximize growth in the first few weeks followed feed restriction. This is of interest, as it implies that appropriate formulation would help to overcome reduced weight gain for birds processed at a younger age than at 8 weeks used in most of their studies.

3. Feed consumption (FC):

At 1, 2, 4, 5, 6 and 7 weeks of age, no significant differences were found in FC among all groups (Table 5) due to feeding time restriction. However, the broilers of EFR6 group consumed more ($P \leq 0.05$) feed than the broilers in FFC group at 3 weeks of age, while the FC differences among EFR9, LFR6 and LFR9 groups were not significant. It was observed that the time of feed restriction had no effect on the overall mean of FC. These results are in agreement with those of Acar *et al.,* (1995).

4. Feed conversion Ratio (FCR):

It was found that, broilers of EFR9 group had significantly ($P \leq 0.05$) better FCR than that of broilers in LFR9 group at 4 weeks of age, while there were no significant differences among FFC, EFR6 and LFR6 groups (Table 6). The broilers of EFR6 and LFR6 groups had significantly ($P \leq 0.05$) better FCR than those of FFC, EFR9 and LFR9 groups at 7 weeks of age. No significant FCR differences were observed among all groups at 2, 3, 5, 6 weeks of age, however LFR6, EFR6 and EFR9 groups had better cumulative FCR by about 5.4, 3.6 and 2.3%, respectively than that of FFC group. Similar results were found by several authors as early feed restriction has been found to improve FCR without adversely affecting broiler market weight (Jones and Farrell, 1992a,b; Roth *et al.,* 1993; Cristofori *et al.,* 1997).

The improvement in FCR noted with the use of early feed restriction may be due to reduced maintenance requirements and perhaps related to a decrease in basal metabolic rate (Zubair and Leeson, 1994) accompanied with a smaller BW during early growth or probably derived from reduction in energy waste (Marks,1991). Plavnik and Hurwitz (1985) reported that the specific energy needs for maintenance may be decreased during feed restriction.

5. Carcass criteria:

The data of carcass yield and carcass parts weights as percentage of live body weight are presented in Table 7. No significant differences were found in carcass percentage, the percentage of blood, feet and shank, head, drumsticks, femurs, drumsticks and femurs, wings, back and skin among all groups. The broilers of EFR6 and EFR9 groups had significantly heaviest ($P \leq 0.05$) carcass weight as compared to the broilers of FFC, LFR6 and LFR9 groups, but it had

significantly lower (P≤0.05) neck percentage. It was found that the birds of EFR9 group had significantly heavier (P≤0.05) breast percentage than those of LFR6 and LFR9 groups, while FFC and EFR6 groups had an intermediate value. However, those results are not in agreement with those reported by Yu *et al.,* (1990) who indicated that of breast muscle of restricted birds was similar to those fed *ad libitum* till 56 days of age.

The data of body organs weights and fat contents as percentage of carcass weight are presented in Table 8. It was found that, feed time restriction had no significant effect on heart, spleen, gallbladder, intestine and fats of gizzard, drumsticks and femurs, heart, and breast as percentage of carcass weight. The broilers of EFR6 group had significantly lower (P≤0.05) percentage of liver than those of FFC and LFR9 groups, and lower percentages of gizzard and giblets than those of FFC, LFR6 and LFR9 groups. However, there are significant (P≤0.05) differences in the percentage of abdominal fat, subcutaneous fat, neck fat and total fat between the groups. Similar results were reported by Plavnik and Hurwitz (1985; 1989) who found that the use of early-life food restriction decreased fat contents in broilers chicks. Boekholt *et al*., (1994) reported that broiler chickens fed *ad libitum* likely consume two or three times energy greater than their maintenance needs and so fat deposition is increased. Summers *et al.,* (1990) showed that the reduction in fat with early feed restriction was accompanied by a reduction in the number of fat cells at maturity.

6. Mortality rate (MR):

It was found that broilers of all restricted fed groups had fewer deaths than those of FFC group (Table 9). The MR was 13.3, 0.00, 6.70, 0.00 and 6.70% for FFC, EFR6, EFR9, LFR6 and LFR9 groups, respectively. It was observed that the EFR6 and LFR6 groups had no mortalities throughout the experimental periods. These results are in agreement with those of McGovern *et al.,* (1997) Urdaneta and Leeson (2002) who mentioned that the use of early feed restriction improved liveability. O'Sullivan *et al.,* (1991) reported a lower rate of mortality caused by Sudden Death Syndrome in broilers restricted for 6 to 27 days of age on an alternate-day feed restriction program.

7. Economical Efficiency (EE):

Results in Table 9 indicate that the birds of EFR6 had heavier body weights than those of the other groups or FFC. Also, birds of EFR6 consumed more feed, thus it had the highest feed cost. The birds of groups FFC, EFR9 and LFR9 had the highest depreciation costs due to the higher mortality rate, but EFR6 and LFR6 had no mortalities. The restricted fed

groups were superior in net revenue per bird compared to FFC control group. All restricted fed groups of EFR6, EFR9, LFR6 and LFR9 exceeded the economical efficiency by 70, 36, 85 and 28%, respectively compared with FFC group. The LFR6 group recorded the best EE value as compared with the other restricted fed groups.

GENERAL CONCLUSION

From obtained the results in this experiment, the most suitable feeding program during high environmental temperature was by the withdrawal of feed for 6 hours (from 9.00 a.m. to 3.00 p.m.) at 5 to 7 weeks of age because it was more economically efficient than other feed restriction programs. Also, using this program was associated with no mortalities throughout the entire experimental period.

Table 1. Composition of the experimental diets.

Ingredients, %	Starter	Grower	Finisher
Ground yellow corn	63.15	69.15	74.40
Soybean meal (44% CP)	25.85	21.00	18.15
Broiler concentrates*	10.43	9.30	6.30
Dicalcium phosphate	0.37	0.50	0.75
Salt	--	0.05	0.15
Limestone	--	--	0.25
Lysine	0.10	--	--
DL-methionine	0.10	--	--
Calculated analysis:**			
ME, Cal/kg	3087	3044	3077
Crude Protein, (%)	22.26	20.23	17.88
Crude fiber, (%)	3.45	3.24	3.09
Crude fat, (%)	2.79	3.02	3.12
Ca, (%)	1.03	0.97	0.90
P (Available, %)	0.51	0.50	0.45

**Calculated on dry matter basis according to NRC (1994).

*** The broiler concentrate contains:** Crude protein, 52%; Crude fiber, 2%; Crude fat, 2.4%;Ca, 7.6%;P (Available), 2.6%; Methionine, 1.7%; Lysine, 2.5%; Salt, 2%; ME,2650 Kcal/Kg. **Each kilogram of broiler concentrate contains the following levels of vitamins and minerals:** Vit A, 120000 IU; vit D3, 22000 IU; vit E, 10000 mg; vit K, 2000 mg; B1, 1000 mg; B2, 5000 mg; B6, 15000 mg; B12, 10 mg; Biotin, 50 mg; Pantothenic acid, 120 mg; Folic acid ,20 mg; Niacin, 450 mg; Chorine chloride, 3600 mg; Dicalcium phosphate, 1000 mg; Fe, 300 m g; I, 10 mg; Mn, 1000 mg; Cu, 1000 mg; Se, 2 mg; Co, 1 mg; Zn, 600 mg.

Table 2. Average (±SE) of indoor temperatures during the experimental period.

Week	Temperature (°C)									
	9AM	0PM	3PM	6PM	9PM	0AM	3AM	6AM	Minimum	Maximum
1	31.3 ±0.6	33.1 ±0.5	34.7 ±0.5	36.1 ±0.3	35.7 ±0.3	34.9 ±0.4	33.9 ±0.4	33.7 ±0.3	29 ±0.2	37 ±0.2
2	31.4 ±0.7	33.1 ±0.6	34.9 ±0.8	36.6 ±0.6	35.1 ±0.7	33.9 ±0.9	32.6 ±0.8	31.4 ±0.8	29 ±0.3	38 ±0.3
3	29.9 ±0.3	32.7 ±0.4	34.7 ±0.5	35.9 ±0.6	33.4 ±0.4	32.0 ±0.4	30.6 ±0.5	29.6 ±0.5	28 ±0.3	37 ±0.3
4	29.6 ±0.3	32.4 ±0.4	34.9 ±0.5	35.6 ±0.3	33.4 ±0.4	32.0 ±0.4	30.6 ±0.3	29.7 ±0.4	29 ±0.3	36 ±0.3
5	28.5 ±0.4	31.2 ±0.6	33.0 ±0.6	33.5 ±0.5	32.2 ±0.6	31.0 ±0.4	29.8 ±0.4	28.5 ±0.3	27 ±0.3	36 ±0.3
6	27.1 ±0.4	29.9 ±0.4	32.4 ±0.4	32.8 ±0.3	30.8 ±0.2	29.8 ±0.2	28.5 ±0.2	27.3 ±0.1	26 ±0.3	34 ±0.3
7	27.0 ±0.3	30.0 ±0.3	32.6 ±0.3	32.9 ±0.1	31.6 ±0.4	30.7 ±0.4	29.3 ±0.3	27.6 ±0.4	26 ±0.3	33 ±0.3

Table 3. Effect of daily feeding time restriction on live body weight (g).

Age (in weeks)	FFC	EFR 6	EFR 9	LFR 6	LFR 9
Day-old	42.4±0.5	42.3±0.6	42.3±0.6	42.7±0.6	42.6±0.4
1	112.0±2.3	111.6±2.2	109.7±2.8	111.8±3.0	109.8±1.7
2	213.9±5.8	221.0±6.1	204.7±8.0	215.8±8.1	201.3±6.6
3	352.7±11.2	390.5±11.4	352.6±15.0	374.1±15.0	367.3±11.2
4	496.9 ± 14.7^{b}	574.1 ± 16.0^{a}	507.9 ± 19.8^{b}	545.2 ± 21.7^{ab}	502.3 ± 17.7^{b}
5	691.4 ± 23.6^{b}	782.7 ± 20.1^{a}	690.9 ± 25.4^{b}	777.3 ± 29.4^{a}	726.5 ± 25.3^{ab}
6	938.1 ± 32.3^{b}	1042.7 ± 26.3^{a}	928.3 ± 29.3^{b}	1010.6 ± 35.9^{ab}	972.9 ± 30.7^{ab}
7	1197.7 ± 43.5^{b}	1342.0 ± 32.3^{a}	1191.5 ± 57.1^{b}	1275.6 ± 48.0^{ab}	1175.7 ± 39.5^{b}

$^{a-----c}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 4. Effect of daily feeding time restriction on body weight gain (g/bird/day).

Age (in weeks)	FFC	EFR6	EFR9	LFR6	LFR9
1	9.9±0.3	9.9±0.3	9.6±0.4	9.9±0.4	9.6±0.3
2	14.6±0.7	15.6±0.7	13.6±0.9	14.9±0.9	13.1±0.9
3	19.8 ± 1.3^{b}	24.2 ± 1.0^{a}	21.1 ± 1.1^{ab}	22.6 ± 1.3^{ab}	23.7 ± 1.4^{b}
4	20.6 ± 1.2^{b}	26.2 ± 1.5^{a}	22.2 ± 1.5^{ab}	24.4 ± 1.4^{a}	19.3 ± 1.4^{b}
5	27.8 ± 2.0^{ab}	29.8 ± 1.8^{ab}	26.1 ± 1.7^{b}	33.2 ± 1.9^{a}	32.0 ± 1.8^{ab}
6	35.2±2.7	37.1±1.6	33.9±1.4	33.3±1.5	35.2±1.7
7	37.1 ± 1.9^{b}	42.8 ± 1.6^{a}	37.6 ± 1.8^{ab}	37.9 ± 2.5^{ab}	29.0 ± 2.2^{c}
Overall mean	23.6 ± 0.9^{bc}	26.5 ± 0.9^{a}	23.4 ± 0.8^{bc}	25.2 ± 0.9^{ab}	23.1 ± 0.8^{c}

$^{a-----c}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 5. Effect of daily feeding time restriction on feed consumption (g/b/d).

Age (in weeks)	FFC	6 Hrs	9Hrs	6Hrs	9Hrs
1	14.6±0.3	14.8±0.3	14.5±0.5	14.4±0.6	14.7±0.3
2	28.1±0.8	30.4±3.2	25.4±3.1	26.6±1.8	27.3±0.4
3	38.8±2.2^{b}	46.9±1.1^{a}	44.8±2.0^{ab}	40.7±3.5^{ab}	41.3±0.9^{ab}
4	50.6±4.1	59.5±0.8	48.1±2.7	54.5±5.0	50.7±3.2
5	70.1±6.5	69.8±3.2	63.6±4.0	69.8±7.4	67.3±3.2
6	86.7±2.6	88.3±3.5	81.2±2.7	88.3±5.5	83.6±6.9
7	98.7±2.6	108.1±0.7	98.6±5.1	98.3±5.1	96.2±6.0
Overall mean	55.3±6.5	59.7±6.7	53.7±6.3	56.1±6.6	54.4±6.3

$^{a-----e}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05)..

Table 6. Effect of daily feeding time restriction on feed conversion ratio (Kg feed/ Kg gain).

Age (in weeks)	FFC	EFR6	EFR9	LFR6	LFR9
1	1.47±0.06	1.50±0.03	1.51±0.02	1.46±0.01	1.53±0.06
2	1.93±0.18	1.95±0.04	1.87±0.11	1.79±0.03	2.08±0.09
3	1.96±0.03	1.94±0.14	2.12±0.10	1.80±0.01	1.74±0.15
4	2.46±0.07^{ab}	2.27±0.08^{ab}	2.17±0.07^{b}	2.23±0.01^{ab}	2.63±0.31^{a}
5	2.52±0.12	2.34±0.14	2.44±0.18	2.10±0.18	2.10±0.10
6	2.46±0.25	2.38±0.05	2.40±0.06	2.65±0.04	2.38±0.02
7	2.66±0.07^{b}	2.53±.02b^{c}	2.62±0.^{10bc}	2.59±0.08^{c}	3.32±.04^{a}
Overall mean	2.21±0.10	2.13±0.08	2.16±0.09	2.09±0.09	2.25±0.13

$^{a-----e}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 7. Effect of daily feeding time restriction on carcass yield and carcass parts weights as percentages of live body weight.

Item	FFC	EFR 6	EFR 9	LFR 6	LFR 9
Live body weight, (g)	1194.3±17.8^{b}	1307.7±27.4^{a}	1169.8±31.4^{b}	1284.0±31.9^{a}	1153.6±26.6^{b}
Carcass weight, (g)	883.8±20.6^{b}	977.7±24.9^{a}	889.7±18.0^{a}	948.2±17.1^{b}	852.5±13.8^{b}
Carcass, (%)	74.0±0.1	74.7±0.5	76.2±1.3	73.9±0.8	73.9±0.7
Blood, (%)	3.3±0.3	3.5±0.2	4.8±1.7	3.3±0.2	3.9±0.2
Feet & Shank, (%)	4.7±0.1	4.9±0.1	4.9±0.3	4.4±0.2	4.6±0.2
Head, (%)	2.9±0.1	3.1±0.1	3.0±0.1	2.8±0.2	3.0±0.1
Neck, (%)	7.1±0.3^{a}	6.5±0.3b	6.0±0.2^{b}	7.2±0.2^{a}	7.2±0.2^{a}
Drumsticks, (%)	11.4±0.3	10.8±0.3	10.7±0.2	10.7±0.2	10.8±0.3
Femurs, (%)	10.1±0.3	10.8±0.2	11.3±0.8	10.5±0.7	10.0±0.2
Drumsticks & Femurs, (%)	21.5±6.4	21.5±0.3	22.0±0.9	21.2±0.8	20.7±0.5
Breast, (%)	16.8±0.3^{ab}	16.9±0.6^{ab}	18.0±0.3^{a}	16.2±0.5^{b}	16.2±0.8^{b}
Wings, (%)	9.1±0.2	9.0±0.2	9.3±0.1	8.9±0.3	9.2±0.6
Back, (%)	14.9±0.9	16.9±0.3	16.5±1.6	16.0±0.8	15.9±1.0
Skin, (%)	6.5±0.5	7.4±0.3	7.1±0.5	7.5±0.4	6.6±0.3

$^{a-----e}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 8. Effect of daily feeding time restriction on body organs weights and fat contents as percentages of carcass weight.

Item	FFC	EFR 6	EFR 9	LFR 6	LFR 9
Carcass weight, (g)	883.8±20.6^{b}	977.7±24.9^{a}	889.7±18.0^{a}	948.2±17.1	852.5±13.8^{b}
Body organs					
Heart, (%)	0.40±0.01	0.41±0.02	0.38±0.03	0.38±0.02	0.43±0.03
Liver, (%)	3.07±0.17^{a}	2.49±0.09^{c}	2.79±0.13^{bc}	2.74±0.07^{abc}	3.23±0.10^{a}
Gizzard, (%)	2.74±0.09^{a}	2.47±0.08^{b}	2.70±0.09^{ab}	2.86±0.90^{a}	2.87±0.09^{a}
Giblets, (%)	6.20±0.12^{ab}	5.36±0.12^{c}	5.85±0.21^{bc}	5.98±0.13^{b}	6.53±0.23^{ab}
Proventriculus, (%)	0.61±0.03^{ab}	0.65±0.04^{ab}	0.64±0.07^{ab}	0.58±0.03^{b}	0.74±0.05^{a}
Spleen, (%)	0.19±0.03	0.22±0.03	0.17±0.03	0.24±0.05	0.25±0.04
Gallbladder, (%)	0.14±0.01	0.16±0.02	0.19±0.04	0.14±0.03	0.15±0.02
Intestine, (%)	5.89±0.43	5.70±0.21	6.35±0.79	6.03±0.38	7.20±0.34
Fat contents					
Abdominal fat, (%)	2.27±0.24^{ab}	2.18±0.40^{ab}	1.63±0.35^{b}	2.89±0.36^{a}	3.00±0.27^{a}
Subcutaneous fat, (%)	0.72±0.22^{ab}	0.52±0.13^{ab}	0.45±0.16^{b}	1.01±0.20^{a}	0.74±0.15^{ab}
Gizzard fat, (%)	1.42±0.20	1.19±0.15	1.80±0.32	1.75±0.29	1.40±0.20
Neck, (%)	2.56±0.30^{a}	1.28±0.16^{b}	1.39±0.14^{b}	2.42±0.31^{a}	3.03±0.26^{ab}
Drumsticks& Femurs, (%)	0.53±0.06	0.49±0.05	0.39±0.08	0.61±0.09	0.65±0.08
Heart, (%)	0.03±0.01	0.06±0.01	0.05±0.02	0.04±.0.01	0.03±0.01
Breast, (%)	0.42±0.09	0.55±0.08	0.65±0.12	0.44±0.07	0.53±0.08
Total Fat, (%)	7.95±0.76^{ab}	6.27±0.58^{b}	6.37±0.86^{b}	9.16±0.99^{a}	8.29±0.75^{ab}

$^{a-----e}$ Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 9. Effect of daily feeding time restriction on mortality rate (%) and economical efficiency.

Item	FFC	EFR 6	EFR 9	LFR 6	LFR 9
Starter diet cost (LE)	1.15	1.31	1.19	1.22	1.17
Grower diet cost (LE)	1.61	1.74	1.49	1.60	1.58
Finisher diet cost (LE)	2.28	2.42	2.22	2.30	2.22
Total feed costs (LE)	5.04	5.47	4.90	5.12	4.97
Mortality Rate (%)	13.3	0.00	6.70	0.00	6.70
Depreciation costs (LE)	1.43	0.00	0.72	0.00	0.71
Total feed & Depreciation costs(LE)	6.47	5.47	5.62	5.12	5.68
Final bird weight (kg)	1.198	1.342	1.192	1.276	1.176
Bird price (LE)	10.78	12.08	10.73	11.48	10.58
Net revenue per bird	4.31	6.61	5.11	6.36	4.90
Economical efficiency	0.67	1.14	0.91	1.24	0.86
Relative economical efficiency (%)	100	170	136	185	128

Price of 1 kg of starter diet = 2.01 LE, Price of 1 kg of grower diet = 1.91 LE, Price of 1 kg of finisher diet = 1.76 LE, Price of 1 kg of live body weight. = 9.00 LE, LE = Egyptian pound.

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الملخص العربى

تأثير التحديد اليومى لوقت التغذية علي الأداء الإنتاجي لكتاكيت اللحم تحت ظروف فصل الصيف فى مصر العليا

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أجريت هذه الدراسة على مائه وخمسون كتكوت تسمين من سلاله شيفر البنى بغرض دراسة تأثير التحديد اليومى لوقت التغذية علي الأداء الإنتاجي لكتاكيت اللحم ومعدل النفوق تحت ظروف فصل الصيف فى مصر العليا.

قسمت الكتاكيت إلي خمسه مجاميع (مقارنة , 4 معاملات) , و اشتملت كل مجموعه على 3 مكررات واشتملت كل مكرره على 10 كتاكيت. المجموعة الأولي تم فيها تغذية الكتاكيت إلي حد الشبع من عمر يوم حتى عمر 49 يوم, والمجموعتين الثانية والثالثه سحب منهما الغذاء لمده 6 و9 ساعات كل يوم من عمر 2 حتى 4 اسابيع على التوالى , والمجموعتين الرابعه والخامسه سحب الغذاء منهما لمده 6 و9 ساعات كل يوم من عمر 5 حتى 7 اسابيع على التوالى. وكان متوسط درجه حراره العنبر من 26-38°م.

يمكن تلخيص النتائج المتحصل عليها كالتالي:

حققت بدارى المعامله الثانيه عند عمر 7 أسابيع وزن جسم أكبر معنوياً ($P\leq0.05$) عن طيور بدارى المجموعه المقارنه والمعاملتين الثالثه والخامسه , بينما كان وزن الجسم فى المجموعه الرابعه متوسطا. وكما كان نفس التأثير على متوسط الزيادة اليومية فى وزن الجسم. ولم يكن وقت تحديد الغذاء والتغذيه حتى الشبع تأثير معنوى على الغذاء المستهلك. كان هناك تحسن غير معنوي فى كفاءه التحويل الغذائى لطيور المجاميع الثانيه والثالثه والرابعه بحوالى 3.6, 2.3, 5.4% على التوالى عن طيور المجموعه المقارنه. وكان معدل النفوق أقل فى كل مجاميع تحديد الغذاء عن المجموعه المقارنه , وكان معدل النفوق 13.3 , 0.0 , 6.7 , 0.0 , 6.7% للمجاميع 1 , 2 , 3 , 4 , 5 على التوالى.

حققت طيورالمعاملتين الثانيه والثالثه وزن ذبيحه اكبر عن طيور المجموعه المقارنه والمعاملتين الرابعه والخامسه. وكان وزن صدر طيور المجموعه الثالثه اكبر معنويا ($P\leq0.05$) عن طيور المعاملتين الرابعه والخامسه , بينما سجلت طيور مجموعه المقارنه والمجموعه الثانيه

وزن صدر متوسط. كان وزن الكبد فى طيور المجموعه الثانيه اقل معنويا ($P\leq0.05$) عن المجموعه المقارنه والمجموعه الخامسه وكذلك وزن القونصه والحوائج عن المجموعه الكنترول والمعاملتين الربعه والخامسه. وجدت اختلافات معنويه بين المجاميع فى ترسيب الدهن فى التجويف البطنى ودهن تحت الجلد ودهن الرقبه والدهن الكلى , وكانت نسبه الدهن الكلى فى طيور المعاملتين الثانيه والرابعه اقل بدرجه غير معنويه ($P\leq0.05$) بحوالى 21.1 , 19.9% على التوالى عن المجموعه الكنترول. ولم توجد أي اختلافات معنوية بين المجاميع في وزن الأعضاء الداخلية , ووزن اجزاء الذبيحه الاخرى.

تحسنت الكفاءه الاقتصاديه فى كل مجاميع تحديد الغذاء (الثانيه, الثالثه, الرابعه, والخامسه) بحوالى70, 36, 85, 28% على التوالى عن المجموعه المقارنه , وكانت المجموعه الرابعه أكفأ من الناحيه الاقتصاديه عن مجاميع تحديد الغذاء الاخرى.

بصفة عامة نستخلص أن انسب برنامج لتحديد الغذاء اثناء ارتفاع درجه الحراره هو تحديد الغذاء لمده 6 ساعات فى اليوم من الساعه التاسعه صباحا وحتى الساعه السادسة مساءا من عمر 5 الى 7 اسابيع لانه يكون أكفأ اقتصاديا عن برامج تحديد الغذاء الاخرى وكذلك بجانب أنه يكون مصاحبا بانعدام نسبه النفوق.