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EFFECT OF AD LIBITUM OR RESTRICTED FEEDING WITH OR WITHOUT SUPPLEMENTAL LYSINE AND METHIONINE ON BROILER CHICKENS PERFORMANCE

By

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Abstract: *One hundred and forty four of one-day Hubbard broiler chicks were used to study the effect of ad libitum or restricted feeding with or without lysine and methionine supplementation on performance, carcass parts and abdominal fat of broiler chickens. All chicks were randomly distributed into 3 groups, (control and 2 groups). Each group included sex replicates of 8 chicks. The three groups were as follows: Birds in group1 (FF) was fed ad libitum from 1 to 42 days of age. Birds in groups 2 and 3 (FR and FRLM) were subjected to a broken feed restriction, whereby the restriction was imposed for 2 days (20% of ad-libitum), then lifted for 2 days at 7 to 42 days of age without or with supplemental lysine (0.2%) and methionine (0.1%), respectively. The obtained results could be summarized as follows: At 6 weeks of age, the boilers of FF group had significantly higher BW ($P \leq 0.05$) than those of FR and FRLM groups. No significant differences in the overall mean of body weight gain were detected among all groups. The FR and FRLM groups had better ($P \leq 0.05$) cumulative feed conversion (FCR) ratio by about 8.0 and 9.9% than that of FF group respectively, without significant differences between the two groups. No deaths occurred among the different groups at all ages. The FF group had significantly higher ($P \leq 0.05$) abdominal fat percentage than that of FRLM and FR groups, while FRLM group had significantly lower ($P \leq 0.05$) abdominal fat percentage than that of FR group. The FRLM group had significantly higher ($P \leq 0.05$) carcass percentage and lower ($P \leq 0.05$) back and wings percentages thane those of FF and FR groups. The groups of FR or FRLM attained higher economical efficiency by 20 %, respectively as compared to FF group.*

It is concluded that, although ad libitum feeding program resulted in higher BW, however it was economically less efficient than that of feed restriction with or without lysine and methionine supplementation. Also, the feed restriction with or without lysine and methionine supplement ion had *feed restriction with or without lysine and methionine supplementation had an equal value of economical efficiency, Nevertheless, lysine and methionine supplementation resulted in higher carcass percentage and lower abdominal fat.*

INTRODUCTION

Chickens are generally regarded as a lean meat. However, carcass of commercial breed have higher fat content, probably due to the selection of broilers on the basis of live weight and less considerations are given to other criteria such as carcass composition. If feeding programs and nutrients requirements are not adjusted appropriately, carcass fat will increase because of the link between fat deposition and rate of gain (Leeson and Summers, 1988).

Because feed represents the major cost (between 60-70%) of poultry meat, much effort has been directed to reduce feed costs and improve the feed conversion ratio. However, allowing birds to unlimited supply of feed can result in the excessive energy and protein consumption which can convert into fat which subsequently adversely affected reproductive performance thereafter (Hocking *et al.*, 2002). Feed restriction programs have been reported to reduce abdominal fat pad content (Plavnik and Hurwitz, 1991). Some reports on broiler feed restriction programs through growing period indicatedits could decrease body weight (Yu *et al.*, 1990), body fat content (Keren-Zvi *et al.*, 1990; Pinchasov and Nir, 1992) and improve feed efficiency (Fontana *et al.*, 1992).

There were numerous reports showing the importance of increasing dietary lysine and methionine concentration to enhance body weight (Fernandez and Parsons, 1996; Ojano-Dirain and Waldroup, 2002), reduce abdominal fat (Mendes *et al.*, 1997; Ojano-Dirain and Waldroup, 2002) and improve feed efficiency of broilers (Potter *et al.*, 1977). The effects of amino acid supplementation on live weight, feed efficiency and fat pad deposition at 49 days of age are more pronounced with feed being restricted for 4 days (20% of ad libitum intake) commencing at 7 days of age. The reason may be due to the fact the bird's ability to absorb and utilize the amino acids can be enhanced following feed restriction (Esmail, 2004).

Therefore, the present study was conducted on broilers to study the effect of *ad libitum* or restricted feeding with or without supplemental lysine and methionine on growth performance, feed efficiency, carcass parts, abdominal fat, and economical efficiency.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Research Farm of Animal and Poultry Production Department, Faculty of Agriculture, South Valley University, Qena, Egypt, from 20th of August to 30th of September, 2005. One hundred and forty four, one-day Hubbard broiler chicks were used in this study. All chicks were individually weighed, and randomly distributed into 3 groups, (control and 2 groups). Each group included sex replicates of 8 chicks each. The birds were raised in batteries in a closed broiler house using controlled system. Each replicate was kept in a cage of 97 × 50 × 45 cm (8 chicks/cage). The three groups were as follows: Birds in group 1 (FF) was fed *ad libitum* from 1 to 42 days of age. Birds in groups 2 and 3 (FR and FRLM) were subjected to a broken feed restriction, whereby the restriction was imposed for 2 days (20% of ad-libitum), then lifted for 2 days at 7 to 42 days of age without or with supplemental lysine (0.2%) and methionine (0.1%), respectively. The chicks were vaccinated against Marek's, Newcastle and Gumboro diseases. Standard commercial management of broiler birds was used throughout the experiment. The chicks were maintained under a 24 hours continuous lighting and water was offered *ad libitum*. The birds received a starter diet (1-3 weeks of age) and then switched to a grower diet (4-6 weeks of age). The Composition and calculated analysis of the experimental diets are shown in Table (1).

Birds of each replicate were individually weighed every week, feed consumption of each replicate was also calculated weekly between the amount of feed supplied and the remaining feed, and body weight gain BWG of each replicate was also weekly calculated between the final and initial bird weight. Feed conversion ratio was calculated weekly by dividing total feed consumed in a cage by the total weight gain of its birds.

Carcass criteria: At 42 day of age, sex birds per group (one per replicate) were chosen and slaughtered for carcass evaluation. Birds were fasted, and then were sacrificed. After slaughtering, the internal organs were removed from the body where the heart, liver, spleen, empty crop, gizzard, proventriculus, duodenum, small intestine and ceca were weighed. Crop, proventriculus, duodenum, small intestine and ceca were lengthened. Head, feet and shanks, wings, and neck were individually weighed. Breast, femurs and drumsticks were cut and 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, carcass parts (carcass weight, feet & shank, head, neck, drumsticks, femurs, breast, wings and back) and abdominal fat were calculated as percentage of pre-slaughter live body weight, while body organs (heart, liver, gizzard, giblets, gallbladder, spleen, crop, proventriculus, duodenum, small intestine and ceca) were calculated as percentage of carcass weight.

Economical efficiency (EE): Feed cost per bird (starter and grower diets) was calculated by multiplying mean FC per bird by the cost of 1 kg of diet. Price of sold birds was calculated by multiplying mean bird weight by price of 1 kg of live weight. Net revenue was calculated by subtracting bird price from total feed costs. Economic efficiency (EE) was estimated by dividing net revenue by total feed costs.

Statistical analysis: Data were subjected to ANOVA using General Linear Models Procedure of SAS software (SAS institute, version 6.12, 1996). Duncan's multiple range test (Duncan, 1955) was used to detect differences among means of different groups.

RESULTS AND DISCUSSION

1-Body weight (BW):

There were no significant differences in BW among all groups up 2 weeks of age (Table 2). During 3-5 weeks of age, the broilers of FF group had significantly higher ($P \leq 0.05$) BW than those of FR group. At 6 weeks of age, the boiler chicks of FF group had significantly higher BW ($P \leq 0.05$) than that of FR and FRLM groups, while FRLM group had significantly higher ($P \leq 0.05$) BW than that of FR group. These results are in agreement with previous finding of McMurtry *et al.,* (1988), Pinchasov and Jensen, (1989), Fontana *et al.,* (1993), Petek, (1999) and Urdaneta-Rincon and Leeson (2002) who reported that full-fed group had significantly ($P \leq 0.05$) heavier average body weights throughout the experiment period than that of feed restriction group.

The reduction in body weight by feed restriction was a reflection of reducing feed consumption (Table 4), which subsequently lowered the energy and protein allowances. These results are in agreement with those obtained from broilers (Hocking *et al.* 2002). It was observed that total weight gain was decreased proportionally to feed consumption. These changes in body weight may reflect the lack of nutrients for cell synthesis in the absence of feed. The regressed crypts and delay in production of entrocytes can explain the retardation of growth in these birds (Pinchasov and Noy, 1993). It was generally recommended that feed restriction start at approximately 6 days of age which usually allows for full recovery of body weight (McMurtry *et al.,* 1988; Zubair and Leeson, 1994). On the other hand, Susbilla *et al.*, (1994) and Lippens *et al.*, (2000), reported that feed restriction at 90% level of *ad libitum* in broilers had similar body weight or close to control birds, and the same growth was achieved as in the *ad libitum* group in spite of the significantly lower body weight. Also, Plavnik and Huwitz (1991) reported that food restriction in broilers had no significant effect on body weight and growth rate.

The improvement in body weight associated with lysine and methionine supplementation might be that the bird's ability to absorb and utilize the amino acids could be enhanced following feed restriction (Esmail, 2004). Fernandez and Parsons (1996) reported that supplementation of the basal diet with either 0.22%-lysine enhanced chick's growth performance. Also, Potter et al., (1997) showed that the addition of DL-methionine to diets increased ($P \leq 0.05$) average body weight of turkey. Dietary methionine levels in excess of those required for maximum growth was essential for maximizing immunity (60-80%), where methionine is required by the thymus-derived T-cell function. Methionine deficiency produces severe lymphocyte depletion and atrophy of the bursa and increases susceptibility to Newcastle disease and coccidiosis. Also, increasing dietary concentration of lysine improved the haemagglutination and agglutinin titres, and IgG and IgM levels (Rama Rao *et al.*, 2004).

2. Body weight gain (BWG):

No significant differences in BWG were detected among all groups at 1, 2, 4 and 5 weeks of age (Table 3). The broilers of FF group gained a significantly more ($P \leq 0.05$) weight than those of FR group at 3 weeks of age, but the birds of FRLM had an intermediate estimate. At 6 weeks of age, the birds of FF and FRLM groups gained significantly more ($P \leq 0.05$) weight than those of FR one, without significant differences in BWG were found among FF and FRLM groups. It was observed that feed restriction with or without supplementation of lysine and methionine had no effect on the overall mean of BWG. These results are in agreement with those of by Plavnik and Hurwitz (1985) who reported that the use of feed restriction had no effect on BWG. Swain and Johri (2000) observed that methionine supplementation did not affect body weight gain. In contrast, beneficial effects of methionine on the weight gain of chicks have been shown by Simon *et al.,* (1995). Kidd *et al.,* (1997) and Mendes *et al.,* (1997) reported that the increasing lysine level in the broilers diets improved ($P \leq 0.05$) weight gain.

3. Feed consumption (FC):

At 1 weeks of age, no significant differences in FC were found among all groups (Table 4). However, the broiler chicks of FF group consumed more ($P \leq 0.05$) feed than those in FR and FRLM groups during 2-6 weeks of age. The differences between FR and FRLM groups in FC were not significant at 2 and 5 weeks of age. But, the broilers of FRLM group consumed more ($P \leq 0.05$) feed than the broilers in FR group at 3 weeks of age, while the broilers of FR group consumed more ($P \leq 0.05$) feed than the broilers in FRLM group at 6 weeks of age. However, the overall mean of FC in FR and FRLM groups were decreased ($P \leq 0.05$) by about 13.3 and 13.0%, respectively as compared with that of FF group, while no significant differences between FR and FRLM groups were observed. Some workers found similar results such as Mario et al., (1990), Fontana et al., (1992) and Acar et al., (1995).

On the other hand, there are conflicting results about the effect of supplemental methionine on broilers feed intake. Schutte and Pack (1995), Yalcin et al., (1999) and Abd-Elsamee (2002) indicated that methionine supplementation had no effect on feed intake of broilers. Nevertheless, Acar et al., (2001) indicated that increasing methionine level in broiler diets had suppressive effect on feed intake. In contrast, El-Daly and Mohamed (1999) reported that methionine level had a significant effect upon feed intake and feed: gain ratio.

4. Feed conversion ratio (FCR):

It was found that, at 1 week of age, no significant differences in FCR were found among all groups (Table 5). The broilers of FR group had significantly better ($P \leq 0.05$) FCR than those of FF group at 2 weeks of age. During 3-5 weeks of age, the broiler chicks of FR and FRLM groups had significantly better ($P \leq 0.05$) FCR than that of broilers in FF group. At 6 weeks of age, broilers of FRLM group had significantly better FCR ($P \leq 0.05$) than those of FF and FR groups. It was observed that, the FR and FRLM groups had better ($P \leq 0.05$) cumulative FCR by about 8.0 and 9.9% than that of FF group, respectively. These results are in agreement with those of Boa-Amponsem *et al.*, (1991), Plavnik and Hurwitz, (1991), Fontana *et al.*, (1992), Su *et al.*, (1999), Urdaneta-Rincon and Leeson, (2002) who reported that feed restriction can be used to improve feed efficiency of broiler chicks. The reason for this improvement in feed conversion under the condition of feed restriction could be due to the reduction in maintenance requirements and perhaps related to the decrease in basal metabolic rate (Zubair and Leeson, 1994). Plavnik and Hurwitz (1985) reported that the specific energy needs for maintenance may be decreased during feed restriction. Also, Urdaneta-Rincon and Leeson, (2002) showed that chicks fed on 95, 90 and 85 % of the control group from 5 to 42 days of age could be utilize the feed as the birds on *ad libitum* feeding. The feed restriction for broiler chicks at levels of 85 and 70%

induces reducing energy requirements, thus the feed conversion was similar with the control (Benyi and Habi, 1998).

Mendes *et al.,* (1997) reported that the increasing lysine level in the broilers diets improved FCR. Also, Ojano-Dirain and Waldroup, (2002) reported that increasing methionine resulted in significant ($P \leq 0.05$) improvements in FCR of broilers. Similar results were noticed by Schutte and Pack (1995) and Abd-Elsamee (2002) who reported a positive influence of methionine on FCR of broilers. In addation, Potter et al., (1997) reported that the addition of DL-methionine to diets increased ($P \leq 0.05$) FCR of turkey. In contrast, Yalcin *et al*., (1999) reported that methionine level had no significant effect on FCR of broilers.

5. Carcass criteria:

The data of carcass yield and carcass parts weights as percentage of live body weight are presented in Table (6). No significant differences in the percentages of feet and shank, neck, drumsticks and breast were found among all groups. The broilers of FRLM group had significantly higher ($P \leq 0.05$) carcass percentage as compared to the broilers of FF and FR groups. The broilers of FR group had significantly higher ($P \leq 0.05$) percentage of head as compared to the broilers of FF group. The broilers of FR group had significantly higher ($P \leq 0.05$) percentage of femurs as compared to the broilers of FF and FRLM groups. The broilers of FRLM group had significantly lower ($P \leq 0.05$) percentages of wings and back than those of FR and FF groups. The FF group had significantly higher ($P \leq 0.05$) abdominal fat percentage than that of FRLM and FR groups, while FRLM group had significantly lower ($P \leq 0.05$) abdominal fat percentage than that of FR group.

McDonald *et al.,* (2001) reported that the percentages of head and neck of feed restriction of broilers group were higher ($P \leq 0.05$) than those of *ad libitum* group. Lebbie *et al.* (1980) observed that deposited abdominal fat of control broilers was significantly higher ($P \leq 0.05$) than that of feed restriction. Also, the birds fed on *ad libitum* feeding recorded significantly higher deposited abdominal fat (1.01%) than that of the feed restricted treatment (0.72 %). These results agreed with those reported by Teeter and Smith (1985) who found that abdominal fat of boiler chicks decreased with feed restriction. In addition, Washburn and Bondari (1978) found that abdominal fat reduced from 2.5 to 0.5 % with feed restriction treatment. Attia (1999) found that feed restriction of broiler chicks at 90, 80 and 70% reduced abdominal fat percentage (1.64, 1.25 and 1.20%, respectively) compared with the *ad libitum* control diet (2.27%). The difference in fat deposition between the *ad libitum* and restricted feeding regime could simply be attributed to the use of body fat during the periods of feed restriction, or the better absorption of amino acids following restriction (Esmail, 2004). McMurtry *et al.*, (1988) reported that the activities of the lipogenic enzymes were depressed during periods of feed restriction. The reduction in the abdominal fat in response to feed restriction at an early age may be as a result of the reduction in the number of fat cells, (Jones and Farrell, 1992).

Moreover, Moran, (1994) and Takahashi *et al.*, (1994) who found that increasing dietary methionine level has been shown to reduce fat deposition in broilers. Also, Gous and Morris (1985), Mendes *et al.*, (1997), Ojano-Dirain and Waldroup, (2002) reported that increasing lysine significantly ($P \leq 0.05$) reduced abdominal fat of broilers. However, some reports indicated that no significant differences in abdominal fat due to methionine addition in the quail diets (Ibrahim *et al.*, 2002) and in the broiler diets (Auvergne *et al.*, 1991). Sibbald and Wolynetz (1986) demonstrated that essential amino acid requirements for optimal breast yields are higher than that of growth. Optimal breast tissue accretion in finishing broilers can be obtained by feeding levels of methionine (Gorman and Balnave, 1995; Schutte and Pack, 1995) and lysine (Acar *et al.*, 1991; Bilgili *et al.*, 1992) above suggested recommendations of NRC, (1994).

The data of body organs weights as percentage of carcass weight and body weight organs lengths are presented in Table (7). It was found that, feed restriction with or without supplementation of lysine and methionine had no significant effect on percentages of liver, gizzard, giblets, spleen, gallbladder, proventriculus, crop and ceca. The broilers of FRLM group had significantly lower ($P \leq 0.05$) percentage of duodenum than those of FF and FR groups. Also, broilers of FRLM group had significantly lower ($P \leq 0.05$) percentage of small intestine than those of FF group. It was observed that, FR and FRLM groups had no significant effect on lengths of proventriculus, crop and small intestine and ceca lengths (Table 7). However, the broilers of FRLM group had significantly lower ($P \leq 0.05$) length of duodenum than those of FF group, while the FR group had an intermittent value.

Cherry and Siegel (1978) showed that chickens of heavier gut weights had slower gastro-intestinal clearance than those of lighter digestive tracts. They also found that a slower clearance of feed for the intestinal tract allows the nutrients greater exposure to the absorptive cells and consequently improves the efficiency of feed utilization. Lilia *et al.*, (1985) reported that the increase size of the digestive organs improved the capacity of the chickens to ingest and digest feed. Others (Nir *et al.*, 1987; Katanabaf *et al.*, 1989) have also shown that a greater weight and length of crop and oesophagus increases the capacity of these organs to retain and control the evacuation of feed from the crop.

6. Mortality rate (MR):

No deaths occurred among the different groups at all ages. Therefore, it seems that feed restriction with or without lysine and methionine supplementation had no effect on MR in spite of its effect on BW.

7. Economical Efficiency (EE):

Results in Table 8 indicate that the birds of FF had heavier body weights than those of the FR and FRLM groups. Also, birds of FF consumed more feed, thus it had the highest feed cost. Both feed restriction groups with or without supplementation of lysine and methionine exceeded the economical efficiency of FF group by 20%, respectively. These results are in agreement with those of Plavnik and Hurwitz (1991) and El-Sagheer and Makled, (2005a,b) who reported that feed restriction of broilers could offer an economic advantage over a continuous *ad libitum* feeding program.

CONCLUSION:

From the results obtained in this experiment, it is concluded that although using *ad libitum* feeding program resulted in higher BW, it was economically less efficient than using feed restriction program either with or without supplementation of lysine and methionine. Also, the program of feed restriction with or without supplementation of lysine and methionine had similar economical efficiency, while feed restriction with supplementation of lysine and methionine resulted in less abdominal fat and high carcass percentage.

Table 1. Composition and calculated analysis of the experimental diets.

Ingredients, %	FF and FR		FRLM	
	Starter (0-3 wks)	Grower (4-6 wks)	Starter (0-3 wks)	Grower (4-6 wks)
Yellow corn, ground	53.17	56.52	52.87	56.22
Soybean meal (44% CP)	32.00	30.00	32.00	30.00
Corn gluten meal (60%	9.00	6.00	9.00	6.00
Vit & Min. Premix*	0.30	0.30	0.30	0.30
Sunflower oil	2.00	4.00	2.00	4.00
Dicalcium phosphate	2.00	1.80	2.00	1.80
Limestone	1.00	1.00	1.00	1.00
Salt	0.38	0.38	0.38	0.38
DL-methionine	0.05	---	0.15	0.10
L- lysine	0.10	---	0.30	0.20
Total	**100**	**100**	**100**	**100**
Calculated analysis:				
ME, Kcal/Kg	3017	3145	3019	3148
Crude Protein, (%)	24.19	21.65	24.55	22.01
Crude fiber, (%)	3.16	3.05	3.15	3.04
Crude fat, (%)	4.62	6.65	4.61	6.63
Ca, (%)	0.93	0.88	0.93	0.88
P (Available, %)	0.52	0.48	0.52	0.48
Lysine, (%)	1.27	1.04	1.47	1.24
Methionine, (%)	0.62	0.41	0.72	0.51
Price of ton diet (LE), 2005	**1654**	**1635**	**1724**	**1705**

*Vitamins and minerals premix provided per kilogram of the diet: Vit A, 10000 IU; D_3, 2000 ICU; Vit E, 10 mg; Vit K, 1 mg; B1, 10 mg; B_2, 5 mg; *B6, 15000 mg; B12, 10 mg; Pantothenic acid, 10 mg; Nicotinic acid, 30 mg; Folic acid, 1 mg; Biotin, 50 mcg;* Chlorine chloride, 500 mg; copper, 10 mg; iron, 50 mg; *I, 10 mg;* Manganese, 60 mg; Zinc, 50 mg, and selenium, 0.1 mg.

Table 2: Effect of *ad libitum* or restricted feeding with or without supplemental lysine and methionine on body weight (g).

Age (weeks)	FF	FR	FRLM
Day-old	45.4±0.4	44.7±0.5	44.6±0.6
1	122.7±1.7	121.3±3.2	110.9±2.8
2	321.8±3.9	311.5±8.7	314.0±1.9
3	660.4±8.6 [a]	629.2±8.5 [b]	640.0±5.9 [ab]
4	1054.0±12.8	1019.8±11.7 [b]	1030.0±5.9 [ab]
5	1494.0±6.0 [a]	1460.3±5.1 [b]	1470±5.9 [ab]
6	1997.9±6.2 [a]	1910.0±3.7 [c]	1975.0±4.8 [b]

[a-----c] Means ± standard error in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 3: Effect of *ad* libitum or restricted feeding with or without supplemental lysine and methionine on body weight gain (g/bird/day).

Age (weeks)	FF	FR	FRLM
1	11.05±0.22	10.93±0.45	11.12±0.11
2	28.44±0.28	27.18±0.93	27.36±0.36
3	48.38±1.00 [a]	45.38±0.26 [b]	46.57±0.65 [ab]
4	56.22±1.23	55.80±1.77	55.71±0.66
5	62.85±0.66	62.93±1.92	62.86±0.74
6	72.0±2.10 [a]	64.24±1.19 [b]	72.14±0.18 [a]
Overall mean	46.49±3.54	44.41±3.33	45.96±3.54

[a-----c] Means ± standard error in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 4: Effect of *ad libitum* or restricted feeding with or without supplemental lysine and methionine on feed consumption (g/bird/day).

Age (weeks)	FF	FR	FRLM
1	19.3±0.5	19.3±0.6	19.4±0.5
2	71.9±0.4 [a]	62.2±0.3 [b]	63.9±2.7 [b]
3	100.2±1.7 [a]	86.2±0.9 [c]	91.1±0.1 [b]
4	107.1±1.6 [a]	89.5±1.4 [c]	93.6±0.2 [b]
5	139.2±5.3 [a]	115.4±1.0 [b]	114.3±1.0 [b]
6	161.5±2.3 [a]	147.3±1.7 [b]	139.3±2.5 [c]
Overall mean	99.9±3.1 [a]	86.6±2.8 [b]	86.9±2.6 [b]

[a----c] Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 5: Effect of ad *libitum* or restricted feeding with or without supplemental lysine and methionine on feed conversion ratio (g feed/g gain).

Age (weeks)	FF	FR	FRLM
1	1.75±0.05	1.78±0.07	1.74±0.06
2	2.53±0.03 [a]	2.30±0.07 [b]	2.34±0.09 [ab]
3	2.07±0.03 [a]	1.90±0.02 [b]	1.96±0.03 [b]
4	1.91±0.03 [a]	1.61±0.06 [b]	1.68±0.02 [b]
5	2.22±0.09 [a]	1.84±0.06 [b]	1.82±0.03 [b]
6	2.26±0.10 [a]	2.30±0.04 [a]	1.93±0.04 [b]
Overall mean	2.12±0.05 [a]	1.95±0.05 [b]	1.91±0.04 [b]

[a----c] Means ± standard error in the same row with different superscripts are significantly different (P≤ 0.05).

Table 6: Effect of ad libitum or restricted feeding with or without supplemental lysine and methionine on carcass yield and carcass parts weights as percentages of live body weight.

Item	FF	FR	FRLM
Live body weight (g)	2009.0±46.9	1959.0±80.1	1972.0±38.2
Dressing (%)	76.1±0.4 [b]	76.0±0.5 [b]	77.6±0.4 [a]
Feet & Shank (%)	4.1±0.1	4.6±0.2	4.6±0.3
Head (%)	2.6±0.1 [b]	2.9±0.4 [a]	2.8±0.1 [ab]
Neck (%)	5.6±0.1	5.5±0.2	5.5±0.3
Drumsticks (%)	11.8±0.3	12.1±0.2	12.5±0.2
Femurs (%)	10.9±0.2 [b]	11.8±0.1 [a]	11.2±0.2 [b]
Breast (%)	21.9±0.8	21.7±0.4	23.3±0.4
Wings (%)	8.1±0.1 [ab]	8.3±0.1 [a]	7.9±0.2 [b]
Back (%)	13.2±0.4 [a]	12.9±0.3 [a]	11.8±0.2 [b]
Abdominal Fat (%)	3.1±0.02 [a]	1.6±0.02 [b]	1.2±0.02 [c]

[a—c] Means ± standard error in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 7: Effect of *ad libitum* or restricted feeding with or without supplemental lysine and methionine on body organ weights as percentages of carcass weight and also body organ lengths (cm).

Item	FF	FR	FRLM
Carcass weight, (g)	1529.4±33.4	1489.7±65.1	1529.3±29.9
Body organ weights (%):			
Heart	0.44±0.02 [b]	0.52±0.02 [a]	0.54±0.02 [a]
Liver	0.22±0.07	2.02±0.09	2.28±0.13
Gizzard	2.29±0.14	2.51±0.07	2.21±0.10
Giblets	4.90±0.19	5.08±0.15	4.99±0.20
Spleen	0.15±0.02	0.14±0.00	0.16±0.02
Gallbladder	0.13±0.02	0.13±0.02	0.10±0.01
Proventriculus	0.50±0.04	0.50±0.07	0.43±0.02
Crop	0.35±0.03	0.34±0.05	0.41±0.06
Duodenum	1.10±0.06 [a]	1.03±0.09 [a]	0.77±0.03 [b]
Small intestine	2.85±0.25 [a]	2.54±0.22 [ab]	2.4±0.11 [b]
Ceca	0.89±0.09	0.78±0.43	0.79±0.06
Body organs length (cm):			
Proventriculus	10.2±0.4	8.9±0.5	9.3±0.4
Crop	7.0±0.4	7.8±0.4	7.6±0.7
Duodenum	29.9±1.1 [a]	27.6±0.8 [ab]	25.4±1.2 [b].
Small intestine	88.8±15.1	91.8±3.4	96.3±5.3
Ceca	17.2±0.7	17.1±0.9	14.8±0.1

[a-----c] Means ± standard error in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 8: Effect of ad libitum or restricted feeding with or without supplemental lysine and methionine on economic efficiency.

Item	FF	FR	FRLM
Starter diet cost (LE)	2.22	1.94	2.03
Grower diet cost (LE)	4.67	4.03	4.14
Total feed costs (LE)	6.89	5.97	6.17
Final bird weight (kg)	1.998	1.910	1.975
Bird price (LE)	14.99	14.33	14.81
Net revenue per bird	8.10	8.36	8.64
Economical efficiency*	1.17	1.40	1.40
Relative economical efficiency (%)	**100**	**120**	**120**

Price of 1 kg of starter diet, 2005 = 1.70 LE,
Price of 1 kg of grower diet, 2005 = 1.72 LE,
Price of 1 kg of live body weight, 2005 = 7.50 LE,
LE = Egyptian pound.
*Net revenue per birds/total feed costs.

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الملخص العربى

تـــأثير التغذيه الحره أو المحدده مع أو بدون اضافه الليسين والمثيونين علي الأداء الإنتاجي لكتاكيت اللحم

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أجريت هذه الدراسة على مائه وأربعه واربعون كتكوت تسمين مـــن ســـلاله الهيبـــارد بغرض دراسه تـــأثير التغذيه الحره أوالمحدده مع أو بدون اضافه الليسين والمثيونين علي الأداء الإنتاجي ودهن البطن وأجزاء الذبيحه لكتاكيت اللحم.

قسمت الكتاكيت عشوائيا إلي ثلاث مجاميعوكل مجموعه اشتملت على ٦ مكررات وكل مكرره اشتملت على ٨ كتاكيت. ا لمجموعة الأولي (المقارنه) تم فيها تغذية الكتاكيت إلـــي حـــد الشبع من عمر يوم الى ٤٢ يوم والمجموعه الثانية تم تحديد الغذاء ابتداء من اليوم السابع بمعدل ٢٠% طبقا للغذاء الذي تم استهلاكه بواسطة مجموعة المقارنة في اليوم السابق لمده يومين ثـــم العوده على التغذيه حتى الشبع لمده يومين اخرين ثـــم تكـــرار ذلـــك حتـــى عمـــر ٤٢ يـــوم ،

والمجموعه الثالثه تم تحديد الغذاء بنفس الطريقه السابقه مع اضافه الليسين (٠,٢%) والمثيونين(٠,١%).

يمكن تلخيص النتائج المتحصل عليها كالتالي:

حققت بداري المجموعه المقارنه عند عمر ٦ أسابيع وزن جسم أكبر معنوياً (P≤0.05) عن طيور بداري المعاملتين الثانيه والثالثه. ولم يكن لتحديد الغذاء مع أو بدون اضافه الليسين والمثيونين والتغذيه حتى الشبع تأثير معنوى على متوسط الزيادة اليومية فى وزن الجسم. وكان هناك تحسن معنوي (P≤0.05) فى كفاءه التحويل الغذائى بحوالى ٨ ، ٩,٩% لطيور المجاميع الثانيه والثالثه على التوالى عن طيور المجموعه المقارنه ، بينما لم توجد اختلافات معنويه مابين طيور المجموعتين الثانيه والثالثه فى كفاءه التحويل الغذائى. ولم يحدث نفوق فى كل المجاميع عند كل الاعمار.

سجلت طيور المجموعه المقارنه نسبه اعلى معنويا (P≤0.05) فى دهن البطن عن طيور المجموعتين الثانيه والثالثه، و نقصت نسبه دهن البطن معنويا (P≤0.05) فى طيور المجموعه الثالثه عن طيور المجموعه الثانيه. كما حققت طيورالمجموعه الثالثه نسبه ذبيحه اكبر (P≤0.05) عن طيور المجموعه المقارنه والمجموعه الثانيه. وتحسنت الكفاءه الاقتصاديه فى كل مجموعه تحديد الغذاء (الثانيه) وتحديد الغذاء مع اضافه الليسين والمثيونين (الثالثه) بحوالى ٢٠ ، ٢٠ % على التوالى عن المجموعه المقارنه.

بصفة عامة نستخلص أن برنامج التغذيه حتى الشبع كان مصحوبا بوزن جسم اكبر ولكنه حقق اقل كفاءه اقتصاديه عن برنامج تحديد الغذاء أو برنامج تحديد الغذاء مع اضافه الليسين والمثيونين ، بينما كان البرنامج الاخير مصاحبا بنقص فى نسبه دهن البطن وتحسن فى نسبه الذبيحه.