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The Influence of Using Various Feed Restriction Methods with /without Dietary Fenugreek and Anise on Carcass Yield and Morphological Traits of Functional Organs for Broiler Chickens Ross 308

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Abstract. *This experiment was carried to investigate the influence of using 3 different feed restriction regimes with or without anise and fenugreek supplemented in the diet on carcass yield, carcass proportions, and morphological traits of visceral organs of broiler chickens on 21st and 42nd days. It has been used 400 unsexed chicks - one-day old which distributed randomly into 10 groups (40 chicks/ group (assigned into 2 replications (20 chicks/ replication). Chicks were reared for 6 weeks and divided from the 2nd week into the following groups:1st group (G1): Ad libitum feeding (control), 2nd, 3rd and 4th groups (G2, G3, and G4): quantitative feed restriction (30%), 5th, 6th and 7th groups (G5, G6, and G7): temporal feed restriction (12 hours/day), 8th, 9th and 10th groups (G8, G9, and G10): diets dilution with sand (15%). 1% of fenugreek powder was added to G3, G6, and G9 diets, and 1% of anise powder was added to G4, G7, and G10 diets. The results showed a significant increase ($p<0.05$) in carcass yield for all feed restriction groups except for G5 which did not differ from G1. Low ($p<0.05$) abdominal fat content in all experimental groups compared with G1. High increases ($p<0.05$) in drumstick and back cuts were achieved by G9 and G8. Also, G9 and G8 caused an augment in heart weight (%). At 21 days, it was noticed that there significant increase ($p<0.05$) in the total weight (%) and the total length of gut (%) for (G5, G8) and (G5, G6), respectively. At 42 days, there was no significant difference between experimental groups and G1 in total weight and length of gut (%). Stability in most of the visceral organs in the 21st day except for G9 which caused a high ($p<0.05$) heart weight (%). Increasing heights ($p<0.05$) in pancreas, adrenal glands, and lungs weights (%) were in favor of G10, (G3, G4, G5, G6, G8, G10), G5, and G9, respectively on the 42nd day. In conclusion, most of the feed restriction groups with dietary plant extracts or sand increased the carcass yield with a mild effect on carcass cuts. Also, each group has its own physiological mechanism to appear the changes or stability in morphological trait for each part visceral organs without any negative influence on bird livability and public health.*

Keywords: *carcass cuts; feed restriction regimes; sand ; fenugreek; anise.*

1. INTRODUCTION

Modern breeds of broiler chickens are characterized by a high growth rate, high feed conversion ratio at early phase of their lifes due to the intensive genetic selection [1]. This prcedure led to emergence of many disadvantages that was accompanied with high increase of production such as high mortality rate which resulted from pathogens, metabolic disturbances, lack of resistance to metabolic diseases and low level of immunity[2], [3]. Also, this caused to development of ascites and sudden-death syndrome, which leads to fat deposition in the abdominal cavity [4]. Therefore, researchers had intended to using different methods for this purpose to reduce the diseases resulting from metabolic processes as well as for lowering production costs, one of these methods is application various feed restriction regimes [5]. Feed restriction

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regimes are one of important means in improving the production performance of birds and reducing the production cost through decreasing the amount of feed intake and reduction the fat content in carcass [6]. By early feed restriction regime, it was scientifically proven that birds can compensate for their lost growth during compensatory growth phase [7],[8]. As a result of ban decision of antibiotics using as growth promoter in poultry diet [9], this has motivated many researchers to find alternatives, such as of natural products represented by plant extracts that have no adverse effects on public health. One of the most important natural products, is fenugreek and anise. Fenugreek (*Trigonella foenum-graecum*) contains many medically important active compounds, such as triogonelline, flavonoids and other compounds, as well as includes proteins, such as albumin, globulin, prolamine and vitamins, unsaturated fatty acids, essential amino acids and sulfur, in addition to mineral elements involving calcium, iron and phosphorous [10]. Anise (*Pimpinella anisum* L.) is a common medicinal plant that contains many active compounds, including phenols, flavonoids, alkaloids and functional proteins [11]. Scientific reports indicated that adding anise seeds to the broiler diets caused an increase in growth rate , significant improvement in productive characteristics [12] and improvement of cellular blood parameters [13]. Sand is non-dissolving and indigestible materials, although it has been proven that it has a positive role when it is added to poultry diets in different proportions for improving body weights and carcass cuts [14],[15].
The present study was aimed to explore the effect of using three feed restriction methods (quantitative and temporal feed restriction and diluted diet with sand) with and without supplementing fenugreek and anise powder to diet from the 2nd week to the 3rd week and its reflection on the carcass cuts and the morphological traits of visceral organs of birds.

2. MATERIALS AND METHODS

2.1. Experiment scheme

This experiment was carried out to investigate the effect of conducting different feed restriction methods with and without adding fenugreek and anise powder to diet during early life (2nd and 3rd weeks) on carcass cuts and the morphological traits of functional organs of broilers. 400 chicks Ross 308 were used at 1 day old, with an average initial weight of 42 g, the chicks were distributed randomly among 10 groups, 40 chicks for each group (20 chicks / replicate). The chicks were reared for 6 weeks. Birds were subjected to feed restriction regime for two weeks only, and then from the beginning of 4th week to 6th week were re-feeding as *ad libitum* (compensatory growth) (tables 1 and 2). The chicks were divided since the 2nd week into the following: 1st group (G1): *Ad libitum* feeding (control), 2nd, 3rd and 4th groups (G2, G3 and G4): quantitative feed restriction (30%), 5th, 6th and 7th groups (G5, G6 and G7): temporal feed restriction (12 hours/day), 8th, 9th and 10th groups (G8, G9 and G10): diets dilution with sand (15%). 1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets

2.2. Diet supplemented materials

Fenugreek and anise extracts were purchased from the local markets in Babylon City/Iraq, these materials were as fine powdery texture with pungent and specific odor to each extract. Sand was used as dilution material in diet. The active bioactive compounds in powders of plant materials were analyzed in the Laboratories of the Ministry of Science and Technology/Environment and Water Office, Baghdad/Iraq. The fenugreek powder contained 135.69 ppm, 20.45 mg/g, and 30.69 mg/g of trigonelline, total flavonoids and total phenols, respectively, while anise powder contained 33.59% and 52.36% of anethol and benzaldehyde present in the essential oil, respectively, and 17.25 mg/g and 25.45 mg/g of total flavonoids and total phenols present in the powder, respectively.

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Table 1. Diet composition used in the experiment with its chemical analysis

Feed stuff	Starter diet (%) (1-2 weeks)	Grower diet (%) (3-4 weeks)	Finisher diet (%) (5-6 weeks)
Soybean meal (46% protein)	30.0	26.5	26.5
Wheat	25.0	28.0	10.0
Yellow corn	20.2	14.70	32.8
Flour	12.5	15.0	15.0
Wheat bran	8.00	9.00	9.00
Premix*	2.5 0	2.50	2.50
Limestone	0.80	0.90	0.90
Sunflower oil	0.50	2.70	3.00
Monocalcium phosphate	—	0.30	0.20
Anti-fungal agent (MINZEL PLUS)	0.10	0.10	—
Choline Chloride + Sodium	0.10	—	—
Sodium bicarbonate	0.10	0.10	—
Table salt	—	0.05	—
Threonine	0.05	—	—
Emulsifier (APSA MOS)	0.05		—
Emulsifier (Lysoforte™ Extend Dry)	0.04	0.04	0.04
Allicine	0.03	—	—
Enzyme mixture (Kemzyme® Plus P Dry)	0.03	—	—
Total	100	100	100
Chemical analysis**			
Crude protein (%)	21.84	20.55	19.46
Metabolizable energy (kcal / kg)	3025.3	3094.05	3144.30
Metabolizable energy to crude protein	138.52	150.56	161.57
Crude fiber (%)	2.73	2.65	2.865
Lysine (%)	1.342	1.248	1.161
Methionine (%)	0.21	0.519	0.470
Methionine + cysteine (%)	0.880	0.862	0.796
Calcium (%)	0.910	0.902	0.810
Available phosphorous (%)	0.791	0.932	0.837

*Produced by Provimi 3110 Company (Jordan) contains 3800 kcal/kg metabolizable energy, 7% crude protein, 1.1% fat, 15% calcium, 4% lysine, 11% available phosphorus, 4.8% sodium, 5.4% calcium, 8.5 % methionine, 8.5% methionine + cysteine, 0.55% threonine, 575000 IU/kg vitamin A, 201250 IU/kg vitamin D3, 3000 mg/kg vitamin E, 138 mg/kg vitamin K3, 138 mg/mg vitamin B1, 345 mg/kg vitamin B2, 1840 mg/ kg vitamin B3, 552 mg/kg vitamin B5, 184 mg/kg vitamin B6, 46 mg/kg vitamin B9, 1000 mg/kg vitamin B12, 6900 g/kg biotin, 20000 mg/Kg choline chloride, 2760 mg/kg iron, 3680 mg/kg zinc, 3680 mg/kg manganese, 9.2 mg/kg selenium, 50 mg/kg iodine.
**Calculated by using NCR [16].

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Table 2. Calculated chemical composition of standard starter and grower diets and exposed diets to quantitative feed restriction and diet dilution by sand

Chemical anlysis*	Standard starters diet	Starter diet - quantitative restriction (30%) for G2, G3 and G4	Starter diet - dilution by sand (15%) for G8, G9 and G10	Standar dgrower diet	Grower diet- quantitative restriction (30%) for G2, G3 and G4	Grower diet - dilution by sand (15%) for G8, G9 and G10
Crude protein (%)	21.84	15.288	18.564	20.55	14.385	17.4675
Metabolizable energy (kcal/kg)	3025.35	2117.745	2571.548	3094.05	2165.835	2629.943
Metabolizable energy to crude protein	138.52	138.52	138.52	150.56	150.56	150.56
Crude fiber (%)	2.73	1.911	2.3205	2.65	1.855	2.2525
Lysine (%)	1.342	0.939	1.140	1.248	0.873	1.060
Methionine (%)	0.21	0.147	0.178	0.519	0.363	0.441
Methionine + cysteine (%)	0.88	0.616	0.748	0.862	0.6034	0.7327
Calcium (%)	0.910	0.637	0.7735	0.902	0.6314	0.7667
Available phosphorous (%)	0.791	0.5537	0.67235	0.932	0.6524	0.7922

*Calculated by using NRC [16].

2.3.Characteristics studied

The percentages of carcass yield and carcass cuts of broilers which involved the relative weights of the main parts of carcass (breast, thigh and drumsticks), secondary parts of carcass (back, wings, and neck) and also edible viscera (heart, liver and gizzard) and abodominal fat were calculated. Weights and lengths of the visceral organs were measured by using a sensitive scale, measuring tape and vernier scale. All the calculations were registered based on the equations coined by [17]:

Carcass yield (%) = carcass weight (g) / live body weight (g) × 100
Carcass cut weight (%) = carcass cut weight (g) / carcass weight (g) × 100
Abdominal fat weight (%) = abdominal fat weight (g) / carcass weight (g) ×100
Visceral organ weight (%) = visceral organ weight (g) /live body weight (g) × 100
Digestive organ length (%) = digestive organ length (cm) / whole gut length (cm) × 100

2.4. Statistical analysis

A complete random design (CRD) was used in analyzing the experiment data to find the effect of different groups on variables, and the significant differences among groups averages were compared by using a Duncan test [18] through application the SAS [19] and on basis of the following mathematical model:

$$Yij = \mu + ti + eij$$

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3. RESULTS AND DISCUSSION

3.1. carcass yield, carcass cuts, edible organs and abdominal fat

Table (3) indicated that all experimental groups except G5 registered high ($p < 0.05$) carcass yield (%) compared with G1. There was no significant differences among groups regarding to the breast, thighs and wings weights (%). On the other hand, high increase ($p < 0.05$) in drumsticks and back (%) was achieved by G9 and G8, respectively. The results of neck weight (%) showed the that G3, G5, G6 and G10 had the same significant level ($p < 0.05$) as G1. There was no significant difference with regard to liver weight (%) between G1 and the rest of the groups except for G2 and G8 which occupied less significant differences ($p < 0.05$). It was observed that high ($p < 0.05$) heart weight (%) was in G8 and G9 compared to G1 . G1 did not differ with other experimental groups regarding to gizzard weight (%). The lowest abdominal fat ($p<0.05$) was recorded in G2, G3 and G8 compared to G1, which had the highest percentage in this trait. The increase in carcass yield referred to an increase in weight of carcass to live body weight and it is one of the economically important markers for expressing the meat quantity that is related to age, gender and live body weight of birds. These results were in consistent with [20] while adding anise to deit of broilers also in agrreement with [21] who stated that was an improvement in carcass yield of broiler subjected to quantitative feed restriction. However, [22] mentioned there was no significant difference when applying the temporal feed restriction of carcass yield of two chicken strains . Also, our results did not agree with [23] who concluded that was a superiority in free feeding control compared with time feed restriction group in carcass yield ratio of broiler chickens. The data were in agreement with [15] who observed when the feed was diluted with sand at rates of 5, 10 and 15% from (7-14) days there was an increase in breast cut of broilers at 42 days. Also, [24] noted when the broiler feed is diluted with wheat bran and sand together at rate (0.7%) in late phase (35 - 45 days) that relative weights of the breast and thighs did not differ from control at 45 days. The results are also agreable with [25] [26], who reported that there were no significant differences in the relative weights of the breast and thigh parts between the early quantitative feed restriction and control at the end of the experiment. Moreover, [27] and [28] referred that was a significant increase in the percentage of the drumsticks weight (%) when 1% fenugreek extract spplemented in diet of broilers. With regard to the abdominal fat weight (%), it was found that feed restriction works to impede the growth of fat tissues by working to limit the growth of these fat cells, whose numerical rates increase with the increase in the weight of the bird during free feeding [29]. This coincided with what was proven that feed restriction led to a significant decrease in the relative weight of the abdominal fat content compared to free-fed birds [6] or during applying the quantitative feed restriction program [30]. Different from what mentioned by [21] that there was a significant decrease in the liver percentage when the temporal feed restriction was performed. Similarly to our data, [31] reported that there was no significant difference in the percentage of liver weight when adding fenugreek to a broiler diet. Also, [23] stated that was no differences statistically in the heart weight (%) when performing the time feed restriction for broilers. The present result also unagreeable with the findings of [32] who indicated that there was a significant increase in the weight of the gizzard for meat type chickens fed a anise supplemented diet.

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Table 3. The effect of feed restriction groups on carcass yield, carcass cuts, edible organs and abdominal fat (%) for broilers at 42 day (mean ± standard error)

Groups	Carcass yield	Breast	Thighs	Drumsticks	Back	Wings	Neck	Liver	Heart	Gizzard	Abdominal fat
G1	70.20± 5.01 d	37.30 ± 1.17	16.41± 0.88	11.77± 0.14 b	16.02 ± 0.20 bcd	10.58 ± 0.42	5.59 ± 0.02 a	2.64 ± 0.05 ab	0.37 ± 0.01cd	1.09 ± 0.00 abc	2.29 ± 0.03 a
G2	71.92± 3.49 c	35.46± 1.26	16.85± 0.24	13.04 ± 0.07ab	17.65 ± 0.86 ab	10.69 ± 0.20	5.21 ± 0.02 ab	2.09 ± 0.04 c	0.38 ± 0.01 cd	0.91± 0.13 bc	1.06 ± 0.54 c
G3	73.94± 0.58 ab	38.17± 0.84	15.25± 0.47	12.16 ± 0.05 ab	16.51± 0.22 abc	11.27 ± 0.23	5.41± 0.38 a	2.28 ± 0.32 abc	0.31 ± 0.03 d	0.86 ± 0.05 c	1.19 ± 0.05 bc
G4	72.89± 1.58b	37.86± 1.52	15.85± 1.17	12.49 ± 0.79 ab	15.78 ± 0.20 bcd	11.32 ± 1.34	4.92 ± 0.58 ab	2.21 ± 0.09 bc	0.40 ± 0.02 bcd	0.99± 0.12 abc	1.75 ± 0.18 abc
G5	70.61± 5.73 d	36.23± 0.91	17.45± 0.39	12.94 ± 0.01 ab	15.91 ± 0.84 bcd	10.41 ± 0.29	5.34 ± 0.39 a	2.68 ± 0.01 ab	0.43 ± 0.01 abcd	1.15 ± 0.08 ab	1.67 ± 0.20 abc
G6	± 71.00 1.19 c	36.67± 1.08	16.47± 1.52	14.32 ± 0.68 ab	14.09 ± 0.59 d	11.04 ± 0.12	5.52 ± 0.36 a	2.46 ± 0.26 abc	0.35 ± 0.00 cd	0.94 ± 0.06 abc	1.85 ± 0.03 ab
G7	72.31± 2.04 b	36.21± 2.86	16.88± 1.87	14.45± ab0.50	15.36 ± 0.62 cd	10.00 ± 0.87	5.17 ± 0.29 ab	2.28 ± 0.01 abc	0.43 ± 0.03 bcd	1.01± 0.04 abc	1.90 ± 0.06 ab
G8	73.34± 1.36 ab	36.01± 0.76	15.46± 0.84	13.56 ± 0.91 ab	18.19 ± 0.42 a	11.21 ± 1.21	4.16 ± 0.15 b	2.06 ± 0.03 c	0.57 ± 0.01a	0.99 ± 0.02 abc	1.38 ± 0.04 bc
G9	74.04± 0.58 a	36.38± 0.30	16.53± 0.61	14.99 ± 0.36 a	15.73 ± 0.30 bcd	10.38 ± 0.50	4.45 ± 0.41 ab	2.75 ± 0.02 a	0.54 ± 0.09 ab	0.91 ± 0.01 bc	1.52 ± 0.28 abc
G10	72.54± 7.14 b	37.81± 3.90	15.29± 0.15	13.65 ± 2.23 ab	16.11± 0.83 bc	9.80 ± 0.17	5.42 ± 0.28 a	2.42 ± 0.18 abc	0.48 ± 0.06 abc	1.17 ± 0.01 a	1.89 ± 0.21 ab
Significance	*	N.S	N.S	*	*	N.S	*	*	*	*	*

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%). 1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets.

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3.2. The relative weights of digestive system organs at 21 day

Table (4) showed there is no significant difference among groups in the relative weights of esophagus, gizzard, small intestine and large intestine. High ($p<0.05$) wights of crop, glandular stomach and total weight of gut (%) were in favor of G6, G8 and (G5 and G8), respectively compared with G1. The reason for the superiority of G6 might be related to content of fenugreek powder in bioactive compounds which detected in our work such as trigonelline, total flavonoids and total phenols that stimulated the bird's appetite for feed through its action on the nervous system [33] and as the result is expansion of crop. The reason for increase of total gut weight in G8 might be due to sand efficiency in diluted diet to expand the digestive system thus increase the digestive tract absorption of nutrients avialability [34]. The results were in agreement with what was indicated by [35] that there was no significant difference in the weight of gizzard when the quantitative feed restriction was carried out at level (20, 25, 30, 35)% for broilers from (14-21) days. Also, [4] stated that was no differences in gizzard weight of broilers exposed to feed restriction for (8-16) hours during periods (7-14, 14-21 and 21-28 days). Moreover, it was proven that weights of small and large intestines (%) did not differ siginificantly from control for broiler subjected to quantative feed restriction [36],[37]. The result are not in consistent with [21] who noticed that there was no significant difference in the crop weight (%)for broilers fed 2 days followed by 1 day fasting.

Table 4. The effect of feed restriction groups on organs weights (%) of digestive system for broilers at 21 day (mean ± standard error)

Groups	Esophagus	Crop	Glandular stomach	Gizzard	Small intestine	Large intestine	Total weight
G1	0.54 ± 0.23	0.55 ± 0.02 b	0.46 ± 0.05b	3.06 ± 0.23	6.83 ± 0.74	0.68 ± 0.08	13.73 ± 0.54 b
G2	0.43 ± 0.01	0.69 ± 0.09 ab	0.64 ± 0.05 ab	2.78 ± 0.45	5.87 ± 0.27	0.89 ± 0.35	12.87 ± 0.57 c
G3	0.32 ± 0.12	0.73± 0.09ab	0.61 ± 0.06 ab	2.72 ± 0.21	5.44 ± 0.23	1.04 ± 0.35	12.33 ± 0.52 c
G4	0.32 ± 0.03	0.72 ± 0.06 ab	0.50 ± 0.01ab	2.72 ± 0.20	5.27 ± 0.46	0.80 ± 0.12	12.36 ± 0.51 c
G5	0.54 ± 0.02	0.56 ± 0.10 b	0.56 ± 0.02 ab	3.65 ± 0.13	7.40 ± 1.90	1.15 ± 0.06	15.99 ± 1.89 a
G6	0.46 ± 0.00	0.98 ± 0.10 a	0.60 ± 0.09 ab	3.50 ± 0.19	5.97 ± 0.84	0.96 ± 0.25	14.37 ± 1.14 ab
G7	0.42± 0.01	0.79 ± 0.04 ab	0.62 ± 0.05ab	4.04 ± 0.80	5.36 ± 0.97	0.79 ± 0.01	14.15 ± 0.30 ab
G8	0.36 ± 0.04	0.78 ± 0.19 ab	0.71 ± 0.00 a	3.69 ± 0.80	7.19 ± 0.95	1.14 ± 0.40	15.72 ± 2.88 a
G9	0.39 ± 0.05	0.55 ± 0.02 b	0.60 ± 0.13 ab	3.35 ± 0.44	6.74 ± 0.71	1.16 ± 0.36	14.66 ± 2.09 ab
G10	0.49 ± 0.02	0.65 ± 0.18 ab	0.48 ± 0.03 ab	3.03 ± 0.70	6.07 ± 1.36	1.08 ± 0.17	13.40 ± 0.90 b
Significance	N.S	*	*	N.S	N.S	N.S	*

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%).1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10diets.

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3.3.The relative weights of digestive system organs at 42 day

The results in table (5) declared that no significant differences between exterimental groups and G1 in esophagus, crop weights (%) and total weight of gut (%) at 42 days. Besides, lack of significant differences among all groups regarding to other weights of digestive segments (%). These results are in agreement with other studies which stated that an early quantitative feed restriction had no influence on the relative weight of the glandular stomach and the small intestine and large intestine at the age of 42 days for broilers [38], [39], [40]. Also, [41] concluded that no significant effect for temporal feed restriction on the relative weight of the gizzard at the end of the experiment.

Table 5. The effect of feed restriction groups on organs weights (%) of digestive system for broilers at 42nd day (mean ± standard error)

Groups	Esophagus	Crop	Glandular stomach	Gizzard	Small intestine	Large intestine	Total weight
G1	0.26 ± 0.00 ab	0.30 ± 0.01ab	0.40 ± 0.04	2.02 ± 0.10 ab	4.04± 0.61	0.81± 0.09	7.12 ± 0.33 ab
G2	0.17 ± 0.05 bc	0.26 ± 0.05b	0.42 ± 0.06	1.46 ± 0.34 b	4.68± 0.48	0.68± 0.18	6.47 ± 0.14 b
G3	0.12 ± 0.02 c	0.19± 0.02b	0.50 ± 0.05	1.68 ± 0.30 ab	4.57± 0.02	0.58± 0.06	6.98 ± 0.36 b
G4	0.22 ± 0.03 abc	0.50 ± 0.16 ab	0.43 ± 0.11	1.84 ± 0.48 ab	4.64± 0.13	0.60± 0.09	6.86 ± 0.13 b
G5	0.24 ± 0.06 abc	0.36± 0.02 ab	0.47 ± 0.07	2.07± 0.05ab	5.18± 0.84	0.74± 0.16	8.11± 0.33 a
G6	0.18 ± 0.05 bc	0.57± 0.04 ab	0.34 ± 0.03	2.12 ± 0.06 ab	4.52± 0.51	0.80± 0.11	7.37 ± 0.78 ab
G7	0.25 ± 0.01abc	0.52 ± 0.15 ab	0.45 ± 0.00	2.04 ± 0.17 ab	3.27± 0.79	0.65± 0.05	6.44 ± 0.06 b
G8	0.24 ± 0.04 abc	0.67± 0.23 a	0.42 ± 0.04	2.44± 0.04 a	5.06± 0.40	0.75± 0.03	8.03 ± 0.65 a
G9	0.35 ± 0.01a	0.58± 0.05 ab	0.48 ± 0.10	2.37 ± 0.17 a	5.03± 0.61	0.75 ± 0.06	8.56 ± 1.47 a
G10	0.22 ± 0.02 bc	0.67± 0.11a	0.47 ± 0.06	2.35 ± 0.23 a	5.29± 1.19	0.68± 0.17	8.39 ± 1.29 a
Significance	*	*	N.S	*	N.S	N.S	*

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%).1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets

3.4. The relative lengths of digestive system organs at 21 day

It is evident from table (6) that G4, G5, G6 and G7 were superior ($p<0.01$) in the length of the esophagus at 21st day. The highest crop length ($p<0.01$) was recorded in G5, G6, G7 and G8, compared to the lowest crop length in G1. The results indicate that there is no significant difference between experimental groups and G1 in relative lengths of the glandular stomach, gizzard, small intestine and the large intestine. However, the total length of gut (%) was increased ($p<0.01$) in G5 and G6 compared to G1. The same data obtained by [36], [37] who stated there was no significant differences in lengths of small and large intestine (%) or lengths of the glandular stomach, small intestine and large intestine (%) [42] while applying quantitative feed restriction at levels (5, 10, 15, 20)% for (7-14). Besides, the result agreed with

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[43] who noticed that there was no significant difference in the length of small intestine when adding fenugreek to abroiler diet . The improvement in birds fed plant extract supplemented diet , for example in fenugreek, may be due to its important role in activity of the digestive organs through its effect on the hypothalamus gland that stimulates the satiety or hunger center in the brain and increase the appetite desire and body weight and thus relex the gut organs morphology[44]. The augement in anise supplemented diet in gut weight (%) might be propebly belongs to its analysed bioactive compounds such as anethol and benzaldehyde, total flavonoids and total phenols.

Table 6. The effect of feed restriction groups on organs lengths (%) of digestive system for broilers at 21 day (mean ± standard error)

Groups	Esophagus	Crop	Glandular stomach	Gizzard	Small intestine	Large intestine	Total length
G1	0.88 ± 0.05 c	0.47 ± 0.00 c	0.38 ± 0.02	0.60 ± 0.01	18.81 ± 0.46	4.50 ± 0.73	25.66 ± 1.14 b
G2	0.99 ± 0.01 bc	0.53 ± 0.08 c	0.47 ± 0.13	0.61 ± 0.05	18.72 ± 1.51	4.09 ± 0.63	25.43 ± 2.41b
G3	1.18 ± 0.02 abc	0.65 ± 0.07 bc	0.38 ± 0.09	0.62 ± 0.04	20.14 ± 1.30	4.05 ± 0.24	27.05 ± 1.79 ab
G4	1.37± 0.02 a	0.63 ± 0.04 bc	0.43 ± 0.02	0.61 ± 0.08	16.59 ± 0.71	5.22 ± 0.19	24.88 ± 0.55 c
G5	1.48 ± 0.06 a	0.89 ± 0.03 a	0.48 ± 0.05	0.70 ± 0.08	21.05 ± 0.03	5.77 ± 0.66	30.39 ± 0.77 a
G6	1.37 ± 0.07 a	0.91 ± 0.05 a	0.49 ± 0.00	0.68 ± 0.04	21.28 ± 2.78	5.22 ± 0.29	29.98 ± 3.10 a
G7	1.22± 0.07 ab	0.83 ± 0.06 ab	0.41 ± 0.03	0.62 ± 0.03	18.76 ± 2.10	5.33 ± 1.04	27.21± 3.35 ab
G8	0.98 ± 0.01 bc	0.78 ± 0.12 ab	0.55 ± 0.00	0.61 ± 0.00	19.33 ± 2.33	4.88 ± 1.32	27.16 ± 3.77 ab
G9	0.93± 0.07 bc	0.46 ± 0.06 c	0.44 ± 0.01	0.54 ± 0.03	18.95 ± 2.62	4.20 ± 0.25	25.53± 2.40 b
G10	1.003 ± 0.24 bc	0.65 ± 0.02 bc	0.36 ± 0.00	0.53 ± 0.02	17.04 ± 0.83	4.80 ± 1.32	24.40 ± 2.40 c
Significance	**	**	N.S	N.S	N.S	N.S	**

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%).1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets.

3.5.The relative lengths of digestive system organs at 42 day

It is clear from table (7) that there was no significant difference between all the different feed restriction groups and G1 with regard to esophagus and total gut length (%). The highest ($p<0.01$) crop, glandular stomach and gizzard lengths (%) were recorded in G8. There was lack of significant differences among all groups in length of the small intestine and large intestine (%). The reason for the statistical similarity of the total gut lengths (%) between G1 and the remaining groups might be due to the possible chance for feed restricted birds to obtain their compensatory growth state after the diet restriction procedure to obtain similar body weights [45] which was positively reflected in the total relative lengths and weights of the digestive system. Our result was in agreement with [37] who indicated that there was no significant

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difference in the length of the small and large intestines (%) at 42nd day when performing early feed restriction for broilers.

Table 7. The effect of feed restriction groups on organs lengths (%) of digestive system for broilers at 42nd day (mean ± standard error)

Groups	Esophagus	Crop	Glandular stomach	Gizzard	Small intestine	Large intestine	Total lenght
G1	0.65 ± 0.04 ab	0.26 ± 0.01 bc	0.19 ± 0.01 b	0.26 ± 0.02 bc	7.81 ± 0.84	2.06 ± 0.10	11.25± 1.05 ab
G2	0.54 ± 0.00 b	0.20 ± 0.00 c	0.18 ± 0.00 b	0.24 ± 0.00 c	7.02 ± 0.13	1.78 ± 0.05	9.98 ± 0.18 b
G3	0.54 ± 0.12 b	0.30 ± 0.01 b	0.21 ± 0.00 ab	0.27 ± 0.01bc	8.10 ± 0.10	2.03 ± 0.12	9.987± 0.10 ab
G4	0.57 ± 0.01 b	0.24 ± 0.02 bc	0.22 ± 0.04 ab	0.27 ± 0.04 bc	7.72 ± 0.80	2.06 ± 0.46	± 11.11 1.34 ab
G5	0.60 ± 0.02 ab	0.25 ± 0.00 bc	0.20 ± 0.00 ab	0.27 ± 0.01 bc	7.29 ± 0.30	2.03 ± 0.00	10.67± 0.32 ab
G6	0.64 ± 0.00 ab	0.30 ± 0.00 b	0.19 ± 0.02 b	0.29 ± 0.01 abc	8.01 ± 0.00	2.10 ± 0.02	11.55± 0.01 ab
G7	0.76 ± 0.02 a	0.31± 0.00 b	0.25 ± 0.00 ab	0.30 ± 0.00 abc	8.59 ± 0.38	2.36 ± 0.04	12.58 ± 0.41ab
G8	0.69 ± 0.01 ab	0.40 ± 0.01 a	0.27 ± 0.02 a	0.34 ± 0.00 a	8.86± 0.02	2.43 ± 0.12	13.02 ± 0.09 a
G9	0.61 ± 0.04 ab	0.27 ± 0.02 b	0.18 ± 0.01b	0.31± 0.01 ab	8.14 ± 0.26	2.39 ± 0.17	11.93 ± 0.04 ab
G10	0.66 ± 0.05 ab	0.31 ± 0.04 b	0.18 ± 0.02 b	0.28 ± 0.01abc	8.22 ± 1.69	2.01 ± 0.28	11.69 ± 1.54 ab
Significance	*	**	*	*	N.S	N.S	*

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%).1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets.

3.6. The relative weights of visceral organs at 21 day

Table (8) revealed that there is no significant difference between the different feed restriction groups and G1 in weights (%) of pancreas and kidneys at 21st day . The results also indicated that there absence of significant differences among all groups weights (%) of the adrenal glands, lungs, bursa of Fabricius, thymus, spleen and liver. G9 had a significant level ($p<0.05$) in heart weight (%) compared to G1. This was in disgreement with [46] who noticed that was a significant increase in weights of liver and pancreas during exposure the birds to temporal feed restriction. However, our data agreed with [47] who indicated that there was no significant differences in the weights of the bursa of Fabricius and spleen (%) for Japanese quail fed restrictively via applying temporal feed restriction regime. The stable heart weight (%) for the most experimental groups might be reflected on stable health case for birds as compared with G1. The result did coincide with [41], [48] who stated that a significant decrease in the weight of heart (%) for broiler subjcted to temporarily restricted diet.

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Table 8. The effect of feed restriction groups on visceral organs weights (%) for broilers at 21 day (mean ± standard error)

Groups	Pancreas	Adrenal glands	Kidneys	Lungs	Bursa of Fabricius	Thymus	Spleen	Heart	Liver
G1	0.34 ± 0.01 ab	0.01± 0.00	0.52 ± 0.00 ab	0.66 ± 0.05	0.24 ± 0.04	0.14± 0.02	0.05± 0.00	±0.00 0.50 b	3.63 ± 0.26
G2	0.30 ± 0.06 ab	0.01± 0.00	0.42 ± 0.04 ab	0.62 ± 0.06	0.19 ± 0.01	0.12± 0.00	0.06± 0.01	0.49 ± 0.04 b	3.88 ± 0.19
G3	0.23 ± 0.05 ab	0.01± 0.00	0.34 ± 0.09 b	0.56 ± 0.19	0.20 ± 0.00	0.15± 0.03	0.09± 0.01	0.50 ± 0.04 b	3.72 ± 0.05
G4	0.20 ± 0.04 b	0.01± 0.00	0.47 ± 0.20 ab	0.63 ± 0.00	0.24 ± 0.04	0.15± 0.03	0.07 ± 0.00	0.59 ± 0.06 ab	3.72 ± 0.45
G5	0.37 ± 0.10 ab	0.01± 0.00	0.42 ± 0.09 ab	0.58± 0.04	0.27 ± 0.00	0.13± 0.00	0.08± 0.00	0.54 ± 0.00 b	3.74 ± 0.24
G6	0.30 ± 0.01 ab	0.01 ± 0.00	0.40 ± 0.03 ab	0.59 ± 0.08	0.23± 0.01	0.19± 0.01	0.07 ± 0.01	0.50± 0.01b	3.04 ± 0.24
G7	0.39 ± 0.05 a	0.01± 0.00	0.57 ± 0.01 ab	0.47 ± 0.06	0.27 ± 0.03	0.19± 0.03	0.07± 0.03	0.56 ± 0.06 ab	3.59 ± 0.29
G8	0.31 ± 0.06 ab	0.01± 0.00	0.53 ± 0.09 ab	0.49± 0.04	0.26 ± 0.09	0.20± 0.09	0.09± 0.03	0.61± 0.03 ab	3.75± 0.31
G9	0.33 ± 0.00 ab	0.01± 0.00	0.64 ± 0.01 ab	0.52 ± 0.04	0.24 ± 0.03	0.14± 0.01	0.09± 0.02	0.02 ± 0.70 a	3.90 ± 0.06
G10	0.33± 0.04 ab	0.01± 0.00	0.68 ± 0.00 a	0.54 ± 0.07	0.28 ± 0.06	0.20 ± 0.03	0.07± 0.00	0.64 ± 0.08 ab	3.28 ± 0.30
Significance	*	N.S	*	N.S	N.S	N.S	N.S	*	N.S

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%). 1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets.

3.6. The relative weights of visceral organs at 42 day

Table (9) showed an increase ($p<0.05$) in weight (%) of pancreas for G10 at 42 days. In the same table, it is evident that there was a significant increase ($p<0.05$) in adrenal glands weights at a level ($p<0.05$) in G3, G4, G5, G6, G8 and G10. Lack of significant differences is obvious among all groups in kidneys, bursa of Fabricius, thymus and spleen. Besides, G5 and G9 had high ($p<0.05$) lungs weights (%).The current data was in agreement with [29],[49] who indicated that there was no significant difference in the relative weight of the bursa of Fabricius at the end of the experiment (compensatory phase) when conducting the quantitative feed restriction either at 7-28 days or at 8-21 days.

4. CONCLUSIONS

Most of the experimental groups has high value of carcass yield with mild effect on carcass cuts. Each group of feed restriction whether using alone or accompanied with dietary fenugreek, anise or sand had special mode of action to cause pivotal roles for changing or stability of anatomical weights and lengths of visceral organs without any clear adverse effect.

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Table (9) The effect of feed restriction groups on visceral organs weights (%) for broilers at 42 day (mean ± standard error)

Groups	Pancreas	Adrenal gland	Kidneys	Lungs	Bursa of Fabricius	Thymus gland	Spleen
G1	0.13 ± 0.01 bc	0.01± 0.00 b	0.44 ± 0.02	0.50 ± 0.00 b	0.10 ± 0.04	0.12 ± 0.02	0.11 ± 0.06
G2	0.12 ± 0.00 c	0.01± 0.00 b	0.43 ± 0.00	0.59 ± 0.14 ab	0.11± 0.05	0.12 ± 0.03	0.12 ± 0.03
G3	0.17 ± 0.03 abc	0.02 ± 0.00 a	0.47 ± 0.13	0.61± 0.05 ab	0.18 ± 0.03	0.12± 0.00	0.15 ± 0.01
G4	0.14 ± 0.00 bc	0.02 ± 0.00 a	0.40 ± 0.00	0.64 ± 0.04 ab	0.11± 0.00	0.16± 0.04	0.11± 0.00
G5	0.23 ± 0.03 a	0.02 ± 0.00 a	0.41 ± 0.08	0.74 ± 0.00 a	0.15± 0.02	0.10± 0.03	0.20± 0.06
G6	0.14 ± 0.00 bc	0.02 ± 0.00 a	0.51± 0.03	0.66 ± 0.01 ab	0.10± 0.03	0.10± 0.02	0.13± 0.03
G7	0.23 ± 0.00 a	0.01 ± 0.00 b	0.50 ± 0.03	0.58 ± 0.00 ab	0.13± 0.01	0.10± 0.03	0.23 ± 0.06
G8	0.20 ± 0.01 ab	0.02 ± 0.00 a	0.53 ± 0.00	0.59 ± 0.07 ab	0.16± 0.02	0.12± 0.00	0.10± 0.00
G9	0.14 ± 0.04 bc	0.01± 0.00 b	0.54 ± 0.04	0.76 ± 0.04 a	0.11± 0.00	0.13± 0.03	0.11± 0.07
G10	0.22 ± 0.01 a	0.02 ± 0.00 a	0.55 ± 0.11	0.62 ± 0.02 ab	0.16± 0.00	0.12 ± 0.02	0.23± 0.01
Significance	*	*	N.S	*	N.S	N.S	N.S

The different letters within same column indicate to presence of significant differences. N.S: non significant, * at level ($p<0.05$), G1: *Ad libitum* feeding (control), G2, G3 and G4: quantitative feed restriction (30%), G5, G6 and G7: temporal feed restriction (12 hours/day), G8, G9 and G10:diets dilution with sand (15%). 1% of fenugreek powder was added to G3, G6 and G9 diets and 1% of anise powder was added to G4, G7 and G10 diets.

REFERENCES

[1] Wepruk, J., 2003. Balancing production., welfare. Faunus Consulting for Susan Church, Manager Alberta Farm Animal Care (AFAC) Association . Alberta Farm Animal Care (AFAC).
[2] Qureshi, M.A. and Havenstein, G.B., 1994. Acomparison of the immune performance of a 1991 commercial broiler with a 1957 random bred strain when fed typical 1957 and 1991 broiler diets. Poultry Sci., 73 (12): 1805-1812.
[3] Alkhalf, A.; Alhaj M., and Al-homidan, I., 2010. Influence of probiotic supplementation on blood parameters and growth performance in broiler chickens. *Saudi J. Biol*. Sci. 17: 219–225.
[4] Saber, S.N., 2016. Effect of quantitative feed restriction on carcass characteristics and some blood parameters in broiler chickens. International Research Journal of Biological Sciences, 5 (10): 1-6.
[5] Oyedeji J.O.and Atteh, J.O., 2003. Reponse of broilers to 3 weeks feed vrestiction initiated at different time periods . Nig. J.Anim. Prod., 30 (2):157-162.
[6] Ocak, N. and Sivri, F., 2007. Liver colorations as well as performance and digestive tract characteristics of broilers may change as influenced by stage and schedule of feed restriction. J. of Anim. Physiology and Anim. Nutr (Berl), 92 (5): 546-553.

ISSN: 2789-6773

[7] Tumova, E.; Skrivan, M.; Skrivanova, V. and Kacerovska, L. 2002. Effect of early feed restriction on growth in broiler chickens , turkeys and rabbits . Czech J . Anim. Sci., 47 (10): 418-428.
[8] Saleh, E.A.; Watlins, S.E.; Waldroup, A.L. and Waldruop, P.W., 2005. Effects of early quantitative feed restriction on live performance and carcass composition of male broiler growth for further processing. J. Appl. Poultry Res., 14 (1): 87 – 93.
[9] Gunal,M.; Yayli,G.; Kaya,O.; Karahan,N. and Sulak,O., 2006. The effects of antibiotic growth promoter ,probiotic or Organic acid Supple- mention on performance intestinal microflora and tissue of broilers . Int . J. Poult .Sci ., 5 (2): 149 – 155.
[10] Nazar, A.E. and EL-Tinay, A.H., 2007. Functionl properties of fenugreek (*Trigonella foenum-graecum*) protein concentrate. Fd Chem.,103: 582-859.
[11] Cowan, M.M., 1999. Plant products as antimicrobial agents. Clinical Microbiology Reviews, 12: 564–582.
[12] Christaki, E.V.; Bonos, E.M. and Florou-Paneri, P.C., 2011. Comparative evaluation of dietary oregano, anise and olive leaves in laying. Japanese quails. Brazilian Journal of Poultry Science,13 (2): 97-101.
[13] Al-Shammari, K. I.; Batkowska J. and Gryzińska, M.M., 2017. Effect of Various Concentrations, of an anise seed powder (*Pimpinella anisum* L.) supplement on selected hematological and biochemical parameters of broiler chickens. Brazilian Journal of Poultry Science, 19 (1): 041-046.
[14] Farjo, G.Y.; Al-Saigh, A.S. and Ibrahim, I.K., 1986. Effects of dietary dilution with sand on broiler performance to 8 weeks of age. British Poultry Science, 3 (27): 385-390.
[15] Al-Taleb, S.S., 2003. Effect of an early feed restriction of broilers on productive performance and carcass quality. J. Anim. and V. Advances, 2 (5): 289 -292,.
[16] NRC, 1994. National Research Council. Nutrient Requirements of Poultry. 9th rev .ed. National Academy Pess, Washington, DC.
[17] Al-Shammari, K.I.A., 2017. The use of chosen plant extracts in various aspects of Japanese quail production . Doctoral dissertation. University of Life Sciences in Lublin, Poland.
[18] Duncan, D.B., 1955. Multiple Range Test and Multiple F. Test. Biometrics, 11:1- 42.
[19] SAS, 2012. Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.
[20] AL-Zuhairi, Z.A. and AL-Tabari, A.S., 2013. Effect the addition of Anis seed (*Pimpinella anisum L.*) powder on production performance and some blood and biochemical parameters in broiler chickens. Kufa Journal for veterinary, 4 (2):12-20.
[21] Ibrahim, K.A. and Saleh, E.S., 2005. Response of male chicks to skip a day feeding programs. Egypt Poul.Sci. 25 (II): 351-371.
[22] Ibrahim, B.M. and Al-Hajo, N.N.A., 2009. Effect of quantitative feed restriction at early age on performance and some characteristics of broilers carcass. Iraqi Poultry Sciences Journal, 4 (1):1-16.
[23] Abdullah, Z.H and Abdul-Razaq, S., 2012. Food rationing system in time and compensatory growth of two strains of Broiler chicken. Iraqi Poultry Sciences Journal, 6 (1): 53-63.
[24] Sahraei, M. and Shariatmadari, F., 2007. Effect of different levels of diet dilution during finisher period on broiler chickens performance and carcass characteristics. International J. of Poultry Sci., 6 (4): 280–282.
[25] Saleh, H.M. and Mossa, R.K., 2017. Effect of use magnetic water and feed restriction time on carcasses traits broiler chicks. Al-Muthanna J. for Agric. Sci.,5(2):73-81.
[26] Mirshamsollah, A., 2013. Effect of different food restriction on performance and carcass characteristics of arian and ross broiler chicks. International journal of Agriculture, 3(3): 495-501.

ISSN: 2789-6773

[27] Alloui, N.S.; Aksa, B. and Alloui, M.N., 2012. Utilization of fenugreek (*Trigonella foenum graecum* as growth promoter for broiler chickens. Journal of World's Poultry Research, 2: 25-27.
[28] Toaha, S.M.; Mollah B.B., and Ahammad, M.U., 2016. Use of dietary Fenugreek (*Trigonella foenum-graecum* L.) seed for the production of safe broiler lean meat. Research in Agriculture Livestock and Fisheries, 3(2): 305-314.
[29] Al-Khateeb,F.S. and Al-Mansour, H.N.S., 2018. The usage of quantitive feed restriction by adding garlic poweder (*Allium satvum* L) on productive perfor mance and carcass traits of broiler chicken. Journal of kirkuk University for Agricultural Sciences, 9(4):1-8.
[30] Leclercy, B.; Kouassi, J. and Simon, J., 1984. Laying performance, egg composition and glucose to lerance of genetically lean or fat meat-type breeders. Poultry Sci., 63: 1609-1616.
[31] Tarq, M.; Mukhtar,A. and Tabidi, M.H., 2014. Effect of fenugreek seed powder on the performance , carcass characteristics and aome blood serum attributes. Adv. Res. Agri. Vet. Sci .,1 (1): 6-11.
[32] Al-Daraji, H.J.; Ibrahim, B.M.; Al-Hayani, W.K., and Abaa, I.R., 2007. The effect of using anise seeds (*Pimpinella anisum*) on productive performance of broiler chickens. Iraqi Poultry Sciences Journal, 2 (3): 152-166.
[33] Al-Habori, M. and Roman, A., 2002. Pharmacological properties in fenugreek- The genus Trigonella , In: Petropoulos, G.A. (Ed.). Taylor and Francis, London and New York.
[34] Picard, M., 1999. Diluted starter diet, growth performance , and digestive tract development in fast and slow growing broilers. J. Appl. Poultry Res., 8: 122 -131.
[35] Sherif, S. K. and Mansour, A.M., 2019. Effect of early feed restriction on broiler erformance , blood and carcass parameters under summer conditions. Egyptian J. Nutrition and Feeds, 22(1):155-165.
[36] Palo, P.E.; Sell, J.L.; Piquer, F.J.; Soto-Salanova, M.F. and Vilaseca, L., 1995. Effect of early nutrient restriction on broiler chickens. 1-Performance and development of the gastrointestinal tract. Poultry Sci., 74: 88-101.
[37] Sugeta, S.M.; Giahetto, P.F.; Malheiros, E.B.; Macari, M. and Furlan, R.L. 2002. Effect of quantitative feed restriction on compensatory gain and carcass composition of broiler. Resquisa Agropecu Brasileira 37 (7):705-709.
[38] Susbilla, J.P.; Frankel, T.L.; Gow, C.B. and Parkinson, G. I., 2000. Effect of quantitative feed restriction on the development of the enzymes involved in protein digestion and growth performance of strain TM 70 broilers. Philpp. J. Vet. Anim. Sci., 26: 44-64.
[39] Shivazad, M., and Seidavy, A., 2001. Investigation on possible compensatory growth of arian broiler hybrid chicks by changing dietary nutrients concentration. Journal of Sci. and Techno. of Agri. and Natural. 5(1):37-46.
[40] Yousefi, K.; Kamyab, A.; Houshmand, M. and Taghipour, A.F., 2001. The effects of early skip – a – day feeding regimen on the performance of Ross male broiler chicken. Poultry Sci., 80 (Suppl. 1): 402-403.
[41] Petek, M., 2000. The Effects of feed removal during the day on some production traits and blood parameters of broilers. Turk. J. Vet. Anim. Sci., 24: 447-452.
[42] Davoodi, M., Mohammad, D. and Alireza, S., 2019. Effect of feed restrictions on performance, blood variables and immunity of broiler. Veterinarski Arhiv, 89 (1): 71-86.
[43] Weerasingha, A.S. and Atapattu,N.S.B.M., 2013. Effects of fenugreek (*Trigonella foenum-graecum* L.) seed powder on growth performance, visceral organ weight, serum cholesterol levels and the nitrogen retention of broiler chicken.Tropical Agricultural Research, 24(3): 289-295.
[44] Hernandez, A.; Madrid, J.; Garcia, V.; Orengo, J. and Meglas, M.D., 2004. Influence of two plant extracts on broiler performances, digestibility and digestive organs size. Poultry Science, 83:169-174.

ISSN: 2789-6773

[45] Balaket, Y.M.J. and Al-Shammari, K.I.A., 2020. productive response of broiler chickens exposed to different feed restriction systems with /without dietary anise and fenugreek. Manuscript accepted for publishing in Journal of University of Babylon for Pure and Applied Sciences, 28 (3).
[46] Katanbaf, M.N.; Dunnington, E.A. and Siegel, P.B., 1989. Restricted feeding in early and late-feathering chickens. 3-Organ size and carcass composition. Poultry Sci., 68: 359-368.
[47] Onwurah, F.B. and Okejim, J., 2012. Effect of restricted feed access time on broiler chickens: a live performance. Indian J. Innovations Dev., 1 (1): 15-17.
[48] McGovern, R.H.; Feddes, J.J.R.; Robinson, F.E. and Hanson, J.A., 1999. Growth performance , carcass characteristics , and the incidence of ascites in broilers in response to feed restriction and litter oiling. Poultry Sci, 78: 522–528.
[49] Liew, P.K.; Zulkifi, I.; Hair-Bejo, M.; Omar ,A.R. and Israf, D.A., 2003. Effect of early age feed restriction and heat conditioning on heat shock protein 70 expression, resistance to infection bursal disease, and growth in male broiler chicken subjected to heat stress. Poult. Sci., 82: 1879-1885.