Plant Archives Volume 20 No. 2, 2020 pp. 6495-6502 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF ADDING DIFFERENT LEVELS OF *ARTEMIA* EGGS TO DIET ON PRODUCTIVE PERFORMANCE AND CARCASS CHARACTERISTICS FOR QUAIL BIRDS.

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Abstract

This experiment was conducted in the poultry research station of for Agricultural Research, Ministry of Agriculture for the period from 5/5/2019 to 16/6/2019 (42 days) to investigated the effect of adding different levels of *Artemia* eggs (AE) to the diet in the production performance of quail chicken during the growth period. In this study, 225 of quail chicks unsexed with primary weight of 8.33 g. Randomly allocated to five treatments and each treatment consists of 45 birds with 3 replicates (15 birds each). *Artemia* eggs were added to the diet as a partial alternative for the protein concentration used 5% of diet over the duration of the experiment and according to the following treatments T1: 2.5%, T2: 2%, T3: 1.5%, T4: 1% and control treatment T5 0% AE. The results showed that the use of *Artemia* eggs in diets led to a significant improvement in the total body weight and the weight at the sixth week of the experiment with a significant decrease ($P < 0.05$) in the rate of the total feed intake compared to the control treatment throughout the study period. The best feed conversion ratio was recorded in the *Artemia* egg's treatments at levels 2.5, 2 and 1.5% compared to the control and T4 (1% AE). The water consumption was showed significantly increase in the *Artemia* egg's treatments compared to the control. However, there are no significant differences appeared in the dressing percentages of viscera edible weights between experimental treatments, while significant differences ($P<0.05$) showed in the intestinal weight in T1 (2.5%) compared to the other treatments. High value ($P<0.05$) was recorded in the characteristics of softness and juiciness of the breast and thigh parts in birds receiving *Artemia* eggs in comparison with the control treatment. Some of the blood traits showed significant superiority of the birds receiving *Artemia* eggs diets as well. In summary, *Artemia* eggs can be considered as a good feed additive, which can have positive effects on the body weight, FCR, body weight gain and feed intake as well as freshness and juiciness of both breast and thigh parts of quail chickens.

Key words: quail chickens, productive performance, carcass characteristics, *Artemia* eggs.

Introduction

Animal protein of high quality is an important source in the nutritional behavior of single stomach animals compared to plant sources (Leeson and Summers, 2001), because it contains good levels of proteins, energy and some essential amino acids necessary to meet the need of birds in balanced proportions, unlike plant proteins that suffer from the lack of these components, which are advised not to be used during the first period of life (Bandar, 2002). There are recent studies on the possibility of using insects such as (locusts, silkworms) The protein content in these insects is 42-63% and the fat content reaches 36% and is palatable and good for animal feed to replace 25-100% of soybeans in some animal feed (Harinder *et al*., 2014). *Artemia*, which is one of the types of crustaceans that contain (55%) protein and is one of the sources that can be used as animal protein in addition to containing high and various levels of unsaturated fatty acids (Baraniya *et al*., 1997) and *Artemia* protein is characterized by being rich in essential amino acids (Evjemo, 2001; Lim *et al*., 2001), showing that *Artemia* contains digestive enzymes (Zarei *et al*., 2005) and the Bombesin hormone which has a role in digestion (Kolkovski *et al*., 1997) and is an excellent source of natural food (Sorgeloos *et al*., 2001). There are Iraqi *Artemia* pools in Basra (Maknoon, 2001) as well as in Baghdad and Diyala (Salman, 2013). Artemia lakes in Iraq suffer from lack of interest in them and left

them to nature. This led to the destruction of fetuses inside the eggs, and therefore the prices of Iraqi *Artemia* eggs decreased compared to imported because the hatching rate decreased 40%. He has to solve the problem of eggs that are badly hatched brine shrimp or that do not hatch at all. The trend has been to include them in nutrition (Praniyah *et al*., 1997), in addition to having a high protein content compared to other protein sources (Zarei *et al*., 2006). And the lack of the need to conduct thermal treatments on fishmeal, meat and bone powders before they are included in the diets of poultry because the thermal treatments cause harmful effects and cause vitamins damage, especially when exposed to poor storage conditions, Klasing, (1998); (Summers and Leeson, 2001). Based on all of the above, this study was conducted, which included replacing different levels of *Artemia* egg in the diets of quail birds during growth period by replacing animal protein and the effect of this on productive, physiological and immunological performance.

Materials and Methods

The experiment was conducted at the Poultry Research Station, Department of the Agricultural Research Department, Ministry of Agriculture-Abu Ghraib for the period from 5/5/2019 to 16/6/2019 and for 42 days to study the effect of replacing *Artemia* egg with the protein concentrate in productive performance and some physiological characteristics and immunogenicity of quail chicken. In the experiment, 225 quail birds were used, one day up to 6 weeks, with an average weight of 8.3 g/birds, randomly distributed to five treatments. The experiment parameters included the following:

T1: The replacement of 2.5% of *Artemia* eggs as substitute for protein concentrate.

T2: The replacement of 2% of *Artemia* eggs as substitute for protein concentrate.

T3: The replacement of 1.5% of *Artemia* eggs as substitute for protein concentrate.

T4: The replacement of 1.5% of *Artemia* eggs as substitute for protein concentrate.

T5: control treatment without any substitute.

The birds received at one day of age and received complete health care according to the preventive health program of the herd during the growth stage and according to the recommendations in effect, as the bird was vaccinated at the age of 7 days with the New castle vaccine Elisa strain by drinking water. The birds were raised in a closed hall with dimensions of 28m × 9m (length × width). Each treatment was divided into 3 replicates (15 birds / replicate). The birds received the experimental ration for two periods from one day of age until the end of the experiment 42 days freely (Table 1).

Productive performance studied included live body weight, weight gain, feed intake and feed conversion ratio. Carcass characteristics included dressing percent the relative weight of the internal viscera and the sensory evaluation for thigh and breast quail meat Baker and Darfler, (1981). At the end of the experiment (6 weeks), blood samples were collected directly at the

Table 1. Percentage of feed ingredients for quail ration and their chemical composition.

Items	T1	T2	T3	T4	T5
Maize	54.5	54.5	54.5	54.5	54.5
Soybean meal 948% protein	37.5	37.5	37.5	37.5	37.5
Protein concentrate	5	5	3.5	3.5	5
Artemia eggs	0	0	1.5	1,5	0
Plant oil	2	2	2	2	2
Limestone	0.7	0.7	0.7	0.7	0.7
Salts	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100
Chemical Analysis					
Crude protein (%)	24.6	24.6	24.9	24.7	24.7
Energy (kilo calorie/ kg diet)	3026.1	3026.1	3015.7	3020.5	3020.5
Methionine +cysteine (%)	0.90	0.90	0.91	0.91	0.91
Lysine (%)	1.41	1.41	1.43	1.42	1.42
Fat (%)	4.72	4.72	4.69	4.71	4.71
Crude fiber (%)	2.82	2.82	2.77	2.79	2.79
Calcium (%)	0.60	0.60	0.62	0.61	0.61
Available phosphorus (%)	0.63	0.63	0.65	0.63	0.63

(1) Protein concentrate used in the manufacture of quail chicken relationship: LAYCON-5 SPECIAL W. Each kg contains: 40% crude protein, 5% raw fat, 3.20% raw fiber, 8.12% moisture, 3.04% calcium, 2.65% phosphorus, 5.39% phosphorus (Calc), 22.51% ash, 3.85% lysine, 3.70% Methaionine, 0.43% tryptophan, 1.66% valine, threonine 1.80%, 4.13% methionine + cysteine, 2.20% sodium, 2157.12 kilocalories / kg energy, 3.00% chloride, 2.52% arginine, 2.40% sodium, 4.16% chloride 200,000 IU vitamin A, 80000 IU Vitamin D3, 600 mg Vitamin E, 50 mg Vitamin K3, 60 mg Vitamin B1, 140 mg Vitamin B2, 80 mg Vitamin B6, 700 mg Vitamin B12, 800 mg Niacin, 20 mg Folic Acid, 180 mg Calcium Pantothenate 7000 mg of chloride Choline, 6073,20 mg Choline, 1600 mg Magnesium, 20 mg Calcium Iodide, 1,000 mg Iron Sulfate, 200 mg Copper Sulfate, 1600 mg Manganese Oxide, 1200 mg Zinc Oxide, 2.40% Sodium, 1200 Sodium (E766), 2.8 mg Propyl Calcite, 2.80 mg citric acid, 33.5 mg antioxidant (BHT); (2) According to the chemical analysis of the diet according to NRC, (1994)

Table 2: Chemical analysis of *Artemia sinica* eggs used in the study.

Treatments	Dry matter	Crude protein	Crude fiber	Ether extract	Ash	Ca	P	Na	Protein (%)	Fat (%)
Artemia **eggsg/kg DM**	964	579	61.9	81.2	315	21	3.6	30	60	20
Manufacturer (Banda)										

slaughter of birds and the following tests were performed included total protein, albumin and globulin concentration in serum. (Bovera *et al*., 2015). Fatty acids in the quail thigh and liver were estimated (AOAC, 1995).

Experiment data were analyzed using a complete randomized design (CRD) to determine the effect of the parameters on the studied traits, and differences between the averages were compared using the Duncan, (1955) polynomial test under the probability level 0.05. Using the Ready Statistical Program (SAS, 2001).

Results and Discussion

Productive Performance

- **Body weight (g):**

Table 5 shows the effect of replacing different proportions of *Artemia* eggs in place of the protein center in the diet in body weight (g) for quails, which shows that there were no significant differences in the first, second and fourth weeks, while the weight increased significantly ($p<0.05$). In the third week of the third treatment (replacing 1.5% of *Artemia* eggs) compared to the first treatment (replacing 2.5% of *Artemia* eggs), whereas the treatments did not differ significantly from 1 and 2% of *Artemia* eggs and control free of *Artemia* eggs, while recorded in the last five weeks and the sixth weeks all of the treatment of Artemia eggs overtook with the expectation of non-substitution control as well as the two substitution coefficients (2 and 2.5%) outweigh the substitution coefficients (1 and 1.5%) of *Artemia* eggs replacing the protein center. The reason for the weight gain in treating brine shrimp eggs in the quail diet is explained by the presence of the hormone pompicin in brine anemia that is important in the process of digestion and secretion of castrin. Gastrin-Releasing Peptide (GRP), which is the absolute peptide of the hormone castrin that is important in digestion processes such as the secretion of infectious cells of pepsin and HCl as well as stimulates pancreas on secretion of pancreatic juice, smooth muscle contraction of the bile, gastrointestinal activity (gastrointestinal motility of the gastrointestinal tract), increased feed consumption and weight increase rates and maintaining energy balance Elsevier, (2013); Vadokas *et al*., (1997); Valenzuela *et al*., (1976). These enzymes play an "important" role in the digestion of *Artemia* within the gut and this explains the increased digestion efficiency when using *Artemia* in nutrition (Lavens *et al*., 2000). Also, the analyzes in the table 14 indicate a superiority in the concentration of total protein, cllobulin and albumin in serum chicken quails in all coefficients of substitution of Artemia eggs on control treatment at the age of 45 days, and in the table 15 the same superiority was observed in the concentration of fatty acids in livers and quails of quail chicken at the age of 45 days for all treatments to replace eggs with brine shrimp over control treatment free of substitution and this is because of the high percentage of total protein 60% and the percentage of fat in *Artemia* 20% (the manufacturer Banda) and the abundance of amino and fatty acids in *Artemia* that needs of birds domesticated table 3. This study was consistent with some studies when using *Artemia* as a good source of energy and protein in feeding domestic birds, as the metabolic energy of *Artemia* 2131-3500 kcal and calorimetry of protein were estimated at 92% in domestic birds (Zarei *et al*., 2006; Aghakhania *et al*., 2009).

Table 3: Amino acids and fatty acids of *Artemia sinica* eggs used in the study.

Fatty acids	Mg/g	Amino acids	Mg/g
Myristic Acid	1.20	Methionine	28.69
Palmitic	15.93	Lysine	74.69
Citric acid	3.91	Tryptophan	6.28
Oleic	18.86	Arginine	28.69
Linoleic	8.99	Threonine	20.78
Linolenic	32.74	Aspartic acid	52.36
Ecosopentaenoic Acid (EPA)	20.63	Glycine	20.63
SFA: Saturated Fatty Acids	29.55	Phenylalanine	25.89
USFA Unsaturated Fatty Acids		Isoleucine	31.89
		Leucine	38.66
	60.98	Serine	18.95
		Valine	25.89
		Histidine	13.69
Ministry of Science and Technology Water Research Service			

Table 4: Prices of *Artemia* eggs in the Iraqi local markets.

Origin	Price ($)	Hatch rate (%)	Weight (g)
Chinese	50	95	450
U.S.A	90	90	425
Korea	80	90	420
Iraq / Basr	5.3	40	250
Iraq/ Baghdad	8	50	1000
Source: Salman, 2013			

Table 5: Effect of replacing different proportions of *Artemia* eggs in replace of the protein concentration in the diet in body weight (g / bird) for quail chicken during 6 weeks of the experiment.

Treatments / Week	Body weight (g / bird)					P-Value
	T1	T2	T3	T4	T5	
1	35.08 ±1.75	34.75 ±1.63	35.77 ±0.40	32.68 ±1.49	31.42 ±0.78	N.S.
2	63.95 ±1.35	62.75 ±1.76	64.55 ±0.50	62.84 ±1.15	61.31 ±0.86	N.S.
3	83.55 ±0.58b	89.33 ±0.98ab	91.37 ±0.31a	89.77 ±3.7ab	87.90 ±87.9ab	*
4	124.86 ±0.78	131.33 ±1.76	128.42 ±3.39	127.64 ±3.43	128.00 ±2.34	N.S.
5	162.33 ±4a	163.40 ±5.43a	161.91 ±5.35ab	160.22 ±3.47ab	155.11 ±3.49b	*
6	194.03 ±0.95a	207.17 ±7.32a	192.00 ±5.58b	193.44 ±1.28ab	176.57 ±0.65c	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

• Weight gain (g/bird):

Table 6 indicates that there were no significant differences in the treatments of the experiment in the first, second and fourth weeks, whereas differences emerged in the third week of the experiment and in favor of coefficients replacing *Artemia* eggs at the place of protein center 2, 1.5 and 1% and the control treatment free of substitution and thus obtained the results obtained In the characteristic of the weight gain in the same curve in which the characteristic of body weight is directed. When the fifth and sixth weeks increased significantly ($p<0.05$), the rate of weight increase in substitution treatment was 2.5% of *Artemia* eggs at the 5 week of life, and in substitution treatment, 2% of *Artemia* eggs at the sixth week of life compared to the control treatment without substitution. These two treatments did not differ with other substitution coefficients, as these coefficients did not differ from the control treatment. It is noted that the rates of weight gain increase during the last week of the experiment, and when studying the growth curve of quail birds, it is noted that these birds grow at a high speed until the age of 5 weeks, after which this speed declines urgently. It was observed that the highest rate of weight gain reached at the fourth week of education, as noted in the table below. And the mature weight of quail reaches 50 days of age and unlike all birds, quail females notice the largest weight of males and this is a unique characteristic of these birds (Nagy and alqysy, 2006).

Table 6: Effect of replacing different proportions of *Artemia* eggs in place of the protein concentration in the diet in Weight gain (g / bird) for quail birds during 6 weeks of the experiment.

The diet in Weight increase rate (g / bird)						P-Value
Treat / Week	T1	T2	T3	T4	T5	
1	26.78 ±1.55	26.45 ±1.75	27.47 ±0.52	24.38 ±1.55	23.12 ±1.05	N.S.
2	28.87 ±1.18	28.00 ±1.49	28.78 ±0.69	30.16 ±1.07	29.89 ±5.95	N.S.
3	19.60 ±1.82b	26.58 ±0.53a	26.82 ±0.83a	26.93 ±3.38a	26.59 ±0.53a	*
4	41.31 ±0.64	42.00 ±0.96	37.05 ±0.76	37.87 ±3.3	40.10 ±1.11	N.S.
5	37.47 ±3.8a	32.07 ±3.91ab	33.49 ±1.87ab	32.58 ±3.39ab	27.11 ±2.35b	*
6	31.70 ±4.9ab	43.77 ±9.5a	30.09 ±4.27ab	33.22 ±2.98ab	21.46 ±2.92b	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

• Feed Intake (g/bird):

Table 7 indicated a significant superiority ($p<0.05$) control treatments and a 1% substitution of *Artemia* eggs in place of the protein center over trial treatments during the first, second, third, fifth and sixth weeks, while substitution coefficients recorded 1.5, 2 and 2.5% the lowest feed consumption rate. However, in the fourth week of the experiment, substitution control coefficients and substitution coefficients of 1 and 1.5% were recorded for feed consumption.

• Feed Conversion Ratio (FCR):

Transplantation of *Artemia* eggs replaced the protein center with the best conversion factor over the substitution-free control treatment, as the control treatment was significantly superior to the trial coefficients during the trial period and the substitution coefficients 1 and

Table 7: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet in feed intake (g / bird) for quail birds during 6 weeks of the experiment.

Feed intake (g / bird)						P-Value
Treat / Week	T1	T2	T3	T4	T5	
1	3.61 ±0.02c	3.72 ±0.025c	3.81 ±0.015b	4.21 ±0.03a	4.46 ±0.025a	*
2	10.30 ±0.035c	10.71 ±0.04b	10.85 ±0.10b	12.57 ±0.14a	11.71 ±0.18a	*
3	13.10 ±1.01c	15.00 ±0.95a	14.28 ±1.21b	15.00 ±1.015a	15.43 ±1.22a	*
4	17.29 ±1.33b	17.28 ±0.78b	18.28 ±0.65a	18.00 ±1.16a	17.43 ±0.88b	*
5	20.71 ±1.18c	20.70 ±1.4c	21.29 ±0.90b	22.71 ±1.30a	22.28 ±1.21a	*
6	23.14 ±1.01c	23.00 ±1.11c	24.71 ±0.92b	25.00 ±1.05a	25.43 ±1.42a	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

1.5% significantly increased ($p<0.05$) over the 2 and 2.5% schedule treatments (8). The reason for the improvement of the food conversion coefficient in favor of coefficients to replace *Artemia* eggs in place of the protein center may be explained by the use of *Artemia* that may be considered a good source of energy and protein in the feed of poultry because it contains energy represented by 2131-3500 kilocalories and a digestibility factor for protein up to 92% (Zarei *et al*., 2006; Aghakhania *et al*., 2009). Also, as it contains important nutrients for growth, table 2, as well as the high content of amino acids and unsaturated fatty acids, table 3. It is also noticed that the values of the food conversion factor in the sixth fifth weeks rise and this phenomenon may be explained by the fact that the growth of quail chicken decreases whenever it reaches the age of sexual maturity and egg production (Nagy and Alqysy, 2006).

Table 9 indicates that there was significant superiority ($p<0.05$) in the rate of weekly feed consumption for both control and treatment cases of *Artemia* eggs 1% over substitution coefficients 1.5, 2 and 2.5%, while the weekly weight increase rates recorded a significant difference ($p<0.05$) in favor of coefficients substituting *Artemia* eggs in place of the protein center for treatment of free substitution control, as well as the case in the live weight ratio. As for the food conversion factor, replacements for *Artemia* eggs were the best nutritional conversion factor, as the substitution control treatment recorded significantly superiority ($p< 0.05$) on coefficients to replace *Artemia* eggs.

Table 8: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet on Feed conversion ratio (FCR) for quail birds during 6 weeks of the experiment.

Feed conversion ratio						P-Value
Treat / Week	T1	T2	T3	T4	T5	
1	0.94 ±0.01c	0.99 ±0.03c	0.97 ±0.01c	1.21 ±0.02b	1.35 ±0.06a	*
2	2.5 ±0.05c	2.68 ±0.02b	2.64 ±0.04b	2.91 ±0.01a	2.74 ±0.04a	*
3	4.96 ±0.01a	3.95 ±0.08b	3.73 ±0.09b	3.95 ±0.07b	4.06 ±0.01ab	*
4	2.93 ±0.03c	2.88 ±0.05c	3.45 ±0.03a	3.33 ±0.01b	3.04 ±0.02b	*
5	3.87 ±0.08c	4.52 ±0.09b	4.45 ±0.07b	4.88 ±0.08b	5.75 ±0.09a	*
6	5.11 ±0.09b	3.68 ±0.04c	5.75 ±0.12b	5.27 ±0.10b	8.3 ±0.19a	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

• Water Consumption Average:

The results indicated in table 10 that there was a significant difference ($p<0.05$) in the rate of water consumption during the age of quail chicken (37, 38, 39) days, for coefficients substituting *Artemia* eggs for treatment of control free of *Artemia* eggs. There is a direct relationship between the body weight, the amount of the diet, the protein quality, the biological processes of the birds, and the average water consumption rate (2011), which indicated low water consumption as a percentage of the body weight of the birds, as it was observed that the second treatment was weight 207.17 g/bird consumed water (50.033) ml water, while the lowest recorded weight for control-free treatment of *Artemia* eggs (176.57 g/

Table 9: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet in the rate of feed conversion ratio, Weight gain rate for quail birds during 6 weeks and Live body weight of the experiment.

Treat / Parameters	T1	T2	T3	T4	T5	P-value
Feed conversion ratio (gm/bird)	102.83±0.01c	105.48±0.17c	108.78±0.09b	113.68±0.14a	112.84±0.04a	*
Weight increase rate (gm/bird)	30.70±0.16ab	33.14±1.21a	30.61±0.96b	30.85±0.21ab	28.04±0.11c	*
Food conversion ratio	3.35±0.015c	3.18±0.083c	3.55±0.08b	3.68±0.009b	4.02±0.01a	*
Live weight (g)	194.04±0.095ab	207.17±7.32a	191.95±5.7b	193.44±1.28ab	176.57±0.65c	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S. No significant differences between the treatments. T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs; T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs; T5: Control treatment is free of substitution.

Table 10: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet in water consumption average for quail birds during 6 weeks of the experiment.

Day	Average water consumption (day/bird/ml)					P-value t
	T1	T2	T3	T4	T5	
37 day	34.633 ±1.23a	31.733 ±0.89a	28.167 ±1.01b	19.20 ±0.63c	14.94 ±1.02d	*
38 day	38.267 ±28.1a	36.700 ±1.93ab	33.033 ±1.76b	19.433 ±0.72c	19.967 ±0.24c	*
39 day	48.767 ±0.72ab	50.033 ±0.54a	45.933 ±1.33b	46.767 ±1.50ab	40.267 ±0.64c	*

*It means that there are significant differences between transactions at the probability A level (0.05). N.S No significant differences between the treatments; T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs; T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs; T5: Control treatment is free of substitution.

bird) consumed (40.26) ml water within 24 hours at the age of 39 days.

Qualitative characteristics

• The carcass characteristics of quail birds:

It was noted in table 11 that significant differences were obtained ($p<0.05$) in living weight and intestinal weight in favor of treatment of replacement (2.5%) of *Artemia* eggs for other trial coefficients, as recorded (203.6, 196.66, 187.66, 179.16, 166.16) g for treatments (T3, T2, T5, T4, T1) respectively. The reason for the low weight of the neighborhood when treating substitution is 1.5% (166.16) is that the carcass samples are taken randomly, since the treatment sample was T3, most of which is male and known to the quail bird that the female is always higher than the female weight and it is not possible to distinguish between the male and the female except when puberty (age 42 days). Also, the same superiority of T1 was also shown in the intestinal weight attribute, as it was (8.58, 7.3, 7.17, 6.97, 6.33) g for treatments (T3, T5, T2, T4, T1), respectively, the decrease in bowel weight for T3 treatment was due to the same reason above in Live weight. The results indicated that there were no significant differences between the coefficients of the experiment in the quality characteristics of the carcass (carcass weight, heart weight, liver weight, abdominal fat and gizzard).

• Sensory evaluation of breast and thigh of quail birds:

Table 12 and 13 indicated the levels of the sensory evaluation of flavor, truffle and juicy in the thigh and breast of quail birds, respectively. It is appear from table 12 that adding different levels of *Artemia* eggs in the diet led to

Table 11: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet in the carcass characteristics of quail birds during 6 weeks of the experiment.

Treat / Parameters	T1	T2	T3	T4	T5	P-value
Carcass weight	129.16±4.94	120.37±8.81	117.96±6.55	127.11±4.73	125.13±6.92	*
Relative weight of the heart	1.25±0.06	1.33±0.13	1.31±0.11	1.42±0.05	1.55±0.13	*
Relative Weight of the liver	3.71±0.32	2.74±0.62	2.86±0.16	3.38±0.6	2.78±0.53	*
Relative Weight of the abdominal fat	1.22±0.42	1.05±0.11	0.90±0.12	1.46±0.33	1.87±0.81	*
Relative Weight of the intestine	6.64±0.54a	5.96±0.45ab	5.37±0.36b	5.74±0.67ab	5.57±0.49ab	*
Relative Weight of the gizzard	2.98±0.21	2.64±0.13	2.92±0.15	2.91±0.23	2.88±0.31	N.S
Live weight	203.60±2.89a	179.16±14.71ab	166.16±10.18b	196.66±12.98ab	187.66±10.62ab	*
Water ratio	63.44±2.48b	67.19±3.04ab	71.00±2.9a	64.63±2.69b	66.68±3.19ab	N.S

*It means that there are significant differences between transactions at the probability A level (0.05). N.S No significant differences between the treatments; T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs; T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs; T5: Control treatment is free of substitution.

Table 12: Effect of replacing different levels of *Artemia* eggs in replace of the protein concentration in the diet in sensory evaluation of breast for quail chicken during 6 weeks of the experiment.

Treat / Parameters	Sensory evaluation of breast					P-Value
	T1	T2	T3	T4	T5	
Flavor	5.8± 0.29	5.7± 0.21	5.8± 0.2	4.9± 0.43	5.1± 0.43	N.S
Juiciness	5.7± 0.39ab	5.7± 0.21ab	6.3± 0.21a	4.9± 0.43ab	4.5± 0.45c	*
Freshness	5.9± 0.23ab	6.1± 0.23ab	6.2± 0.24a	5.1± 0.51bc	4.8± 0.44c	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

Table 13: Effect of replacing different proportions of *Artemia* eggs in replace of the protein concentration in the diet in sensory evaluation of thigh segmentations for quail chicken during 6 weeks of the experiment.

Treat / Parameters	Sensory evaluation of thigh segmentations					P-Value
	T1	T2	T3	T4	T5	
Flavor	5.8± 5.8	5.6± 5.6	5.4± 5.4	5.6± 5.6	4.3± 4.3	N.S
Juiciness	5.9± 5.9ab	6.3± 6.3ab	6± 6a	5.4± 5.4bc	5± 5c	*
Freshness	6± 6ab	6.1± 6.1a	6.2± 6.2a	5.5± 5.5bc	4.8± 4.8c	*

*It means that there are significant differences between transactions at the probability A level (0.05); N.S No significant differences between the treatments.
T1: Replacement of 2.5% *Artemia* eggs; T2: Replacement of 2% *Artemia* eggs;
T3: Replacement of 1.5% *Artemia* eggs; T4: Replacement of 1% *Artemia* eggs;
T5: Control treatment is free of substitution.

the absence of Significant differences (P<0.05) in the flavor values of all thigh segment treatments as significant differences (P<0.05) were observed in juices of T3 as the highest evaluation value was recorded (6.3) compared to the control group T5 as it recorded the lowest value of 4.5, Also, there was a clear significant improvement (P<0.05) in the purity values of coefficients to replace *Artemia* eggs in place of the protein center compared to control in D values were (5.9, 6.1, 6.2, 5.1, 4.8) for carcasses treatments (T1, T2 and T3 and T4 and T5) consecutive. Likewise, the addition of *Artemia* eggs to all concentrations resulted in no significant differences in the flavor values for all treatments for the chest segment table 13, while the highest values for the juicy attribute were recorded when treating T3 as the evaluation value reached (6) compared to the control group T5 as it recorded the lowest value (5) and also T2 and T3 were significantly superior (P<0.05) over trial factors, and *Artemia* egg substitution coefficients were reported significantly higher in tuberculosis treatment than free substitution control. These results are unique in this research, due to the lack of research specialized in this evaluation. The reason for the effect of substitution of *Artemia* eggs instead of the protein center in the diet may be explained by the sensory taste of juiciness and freshness due to increased fatty acids in the thigh (Table 15) and also to the amount consumed water table 10 and the high percentage of vitamin E concentration in *Artemia* (454 IU/kg) important in improving bird meat (Greco, 1998) and the amount of vitamin E needed by the bird's body is 15 IU/ kg dry weight NRC, (1994).

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