Influence of Different Skip Feeding Programs on Physiological Parameters of Broiler Chicks

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Received: 01/08/2020 Accepted: 04/09/2020

Abstract

The objective of this project was to determine the impact of various skip feeding programs on some immune organs and blood parameters in both sexes of broiler. A total of 260 broiler chicks, males and females have been divided into four groups each comprising five replicates of 13 chicks per replicate as follow T1: Control: (Feed is provided continuously and permanently).(T2) Skip every 1 day: (Provide the feed for one day and skip it at the next day and so on until the age of 42 days).; (T3) Skip every 2 days: (Providing the feed for two consecutive days, cutting it the next day, and so on; (T4) Skip every 3 days: (Feed is available for three days in front of the chicks, and chicks were remained without feeding at the next day; the treatments were applied from 15 days old up to 42 days of age. Skip programs had no significant effects on bursa of fabricius and spleen percentages, while skip every one-day pancreases percentage in males was significant; there was no significant effect on haemoglobin of males. However, packed cell volume (PCV), White blood cells (WBC)s in females and Heterophile percentage in both sexes were significantly affected ($p<0.05$) by skip programs, also, there was no significant effect on red blood cell (RBC)s, Esophil and basophile percentages in both sexes. Males showed significant compensatory ($p<0.05$) of lymphocytes percentage than females in T4, but monocytes had no differences in both sexes. There was a minor effect of different skipping on blood biochemical. Glucose and cholesterol concentrations were not affected by treatments in both sexes, while total protein and urea concentration were affected just in females.

Key words: Broiler, Skip-a-day feeding, Hematological and Immunity parameters.

Introduction:

During the past 50 years, broiler chickens' growth efficiency has improved dramatically, primarily due to genetic development, dietary changes and regulated environments (Orso *et al.*, 2019). Rapidly growing chicks may have higher mortality in response to infectious or metabolic diseases compared to slower-growing bird groups (Yunis *et al.*, 2000). The production of poultry meat has become one of the most diverse sectors of animal development. Poultry meat is considered amongst the available meat sources to be safe and nutritious (Abdelraheem *et al.,* 2019). Since feed costs account for more than 70 percent of all broiler chicken production costs, restricted feeding avoids wastage of feed and thus minimizes production costs (Khurshid *et al.*, 2019). The rapid growth of the poultry industry and production, particularly at the farmer and small-scale producer's level, produced and developed a range of genetic, physiological, and nutritional management schemes and manipulations to deliver the maximum possible bird fecundity resulting in the greatest possible economic performance. The feeding of poultry may be done as supplying the feed ad in various systems and regimens. Libitum, food of convenience, once or twice a day and subject to restriction (Henuk and Dingle, 2002). In broiler output, various methods of feed restriction are used to increase feed utilization efficiency and weight gain, and these include intermittent feeding, skip-a-day feeding. Skip a day feed is a way of reducing fast development and wasn't it tested extensively for broiler chickens (Dozier *et al.*, 2002). Skip-a-day feeding programs which provide small feed allocations and are widely used in the growth restriction programs of the broiler breeder. Removing feed for 24-hour periods during the starter period reduces early rapid growth and better meat yield in broiler chickens (Ali *et al.*, 2011). Afsharmanesh *et al.*, (2016) stated that the most effective strategy for reducing the occurrence of metabolic disorders is applying broiler chickens to an early feed restriction. Hematological parameters serve as strong indicators of bird physiological state (Saied *et al.,* 2011). In chickens, haematological parameters are seen to be affected by various factors such as age, sex, season, and diet. Packed cell volume (PCV), the concentration of haemoglobin (Hb), and counts of red blood cells (RBC) were reported to increase with age (Islam *et al.*, 2004). Differences in haematological parameters can be used to assess the body status and stresses induced by environmental, nutritional and biological factors (Olukomaiya *et al.*, 2014).

Dawood and Mohammed, (2015), recorded that human issues were associated with the consumption of poultry meat, which was primarily due to its fat and cholesterol content, so researchers were confronted with how to produce lean meat that can be accomplished by dietary manipulation. Restriction of physical feed showed no major impact on carcass, serum, or abdominal fat pad cholesterol and triglycerides. Faisal *et al.*, (2008) recorded that total plasma protein, albumin, globulin, lipids, cholesterol, triglycerides, and glucose were reduced to 70 percent of ad-libitum due to feed restriction of quails. Some programs for restricting early feeding had beneficial effects on the humoral immune response. After all, few studies have examined the impact on immune function in broiler chickens of feed restriction, as well as genetic selection (Orso *et al.,* 2019). The goal of this experiment was to recognize the impact of various skip feeding programs on some of the immune organs, blood cell parameters and blood plasma in both sexes of broiler chickens.

Materials and methods:

The experiment was carried out at the department of Animal Science, College of Agricultural Engineering Sciences, Sulaimani University / Kurdistan Region of Iraq. A total of 260 fifteen days old chicks of Ross (308) from both sexes were used in the present experiment. For two weeks, the birds have been grown in one group (period of adaptation). Such chicks were weighed and distributed among pens on day 14^{th}, were the mean body weight in each cage and its variations were almost identical. These have been subsequently assigned randomly to four treatment classes, so that five replicates of 13 chicks per replicate were provided for each treatment. In age 42 days one male and one female were chosen randomly from each replication (four males and four females from each treatment).

All chickens had access to water and feed *ad libitum* and the diets were available as mash type table (1), birds provided the same pre-starter diet up to 14 days of age. Chickens were fed start diet (age 15 to day 21), grower diet (age 22 to day 35), and finish diet (age 42 from day 36).

The studied treatments were as follow; T_1: Control: (Feed is provided continuously and permanently for birds). (T2) Skip every 1 day: (Provide the feed for one day and cut it the next day and so on until the age of 42 days). (T3) Skip every 2 days: (Providing the feed for two consecutive days, cutting it the next day, and so on until the age of 42 days). (T4) Skip every 3 days: (Feed is available for three days in front of the chicks, chicks were remained without feeding the next day, and so on until the end of the study). However, the experiment scheme was as illustrated in Figure (1).

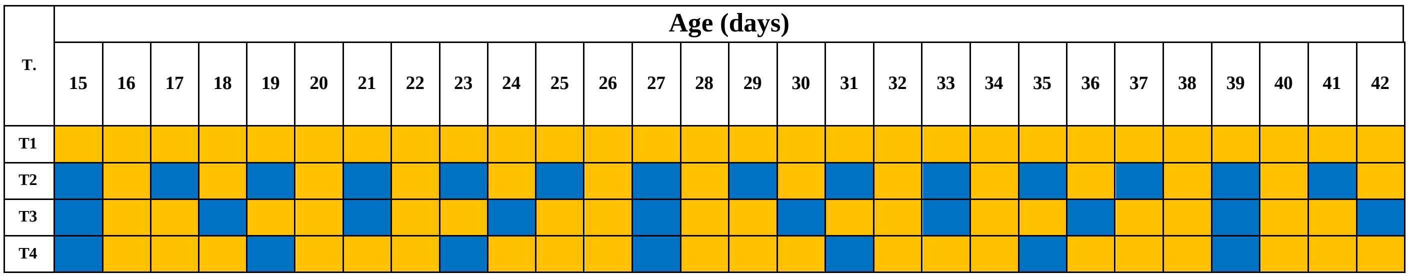

Figure 1. Applied skip system

The orange colour indicates the days when feed is provided to the chicks

The blue colour indicates the days when feed was banned from the chicks

Table 1. Nutrition composition

Ingredient, % as a basis for feed	Starter diet (15-21 days) %	Growth diet (22-35 days) %	Finisher diet (36-42 days) %
Wheat	23.6	23	27.5
Corn	35.5	34.8	39.7
Meat and bone meal (40%)	3	0.6	0.4
Soybean meal (%44)	29.9	33.04	23.28
Sunflower seed Oil	4	5	5
Dual-calcium phosphate	2.3	1.94	1.86
Limestone	1.15	1.16	1.11
Salt	0.25	0.25	0.25
Methionine	0.2	0.11	0.8
Premix[1]	0.1	0.1	0.1
Total	100	100	100
Chemical composition of the diets[2] (calculated)			
**** Crude protein %**	22	20	17
*** Metabolizable energy Kcal/kg**	2919	3056	3079
**** Ether extract %**	5.3	6.05	6.12
*** Crude fibre %**	3.57	3.65	4.00
**** Calcium %**	1.19	1.11	1.22
**** Phosphor %**	0.76	0.55	0.57
*** Lysine %**	1.19	1.2	1.01
*** Methionine + Cysteine %**	0.89	0.92	0.89

[1]Premix (Vitamin. A 800.000 IU; Vitamin. D3 170.000 IU; Vitamin. E 980 mg; Vitamin. K 95 mg; Vitamin. B1 13 mg; Vitamin. B2 220 mg; Vitamin. B6 75 mg; Vitamin. B12 800 mg; Folic acid 20 mg; Choline Chloride 12.000 mg; Antioxidant 1.900 mg; Iron 2.500 mg; Copper 400 mg; Zinc 2.600 mg; Selenium 7.5 mg; Calcium 24.00%; Sodium 5.40%; Phosphorus 8.40%; Methionine 5.40%; Methionine + Cystine 5.70% and Lysine 5.60%. [2]The nutritional requirement determined according to NRC (1994).

Data collection:

Viscera internal rate of ingested into the live body weight:

After slaughtering the birds at age 42 days, and separation of the edible viscera (Bursa of Fabricius, Pancreases and Spleen), each proportion was calculated according to the following equation:

$$\textbf{Weight of viscera organs}\ \% = \frac{\textbf{weight of bursa of Fabricius, pancreases and spleen}}{\textbf{live body weight (g)}} \times \mathbf{100}$$

Physiological traits:

1. **Blood cell parameters**

Four ml of blood was collected in sample bottles containing ethylene tetra acetic acid (EDTA), an anticoagulant from two birds per replicate, for haematological trials of the jugular vein with a syringe and a needle. The sample bottles were immediately capped and gently rolled to ensure the anticoagulant was mixed with the blood, samples were placed in a refrigerator, and analyzed within 24 hours. Packed Cell Volume (PCV), as defined by Kelly (1979), was calculated using the Micro hematocrit process. After the correct dilution, Red Blood Cell (RBC)s and [White Blood Cell (WBC)s, Heterophil, Eosinophil, Basophil, Lymphocytes and Monocytes] were calculated using the Neubauer hemocytometer. The concentration of hemoglobin (Hb) was calculated using a cyanomethaemoglobin process using solution Drabkin as diluents (Jain, 1986).

2. **Blood Plasma (biochemical parameters)**

Blood samples were obtained in the slaughter process from the age of 42 days using anticoagulant-containing pipes and then blood samples were placed in a TRIUP 80-2 centrifuge at 6000 r / min for 5 minutes to isolate blood plasma. Then the following experiments were carried out (Glucose, Uric Acid, Total Protein and Cholesterol). The concentration of uric acid in the plasma of blood was measured using an amount (Kit) supplied by the Spanish company (LINEAR) and then scan took place based on the steps suggested by the Company processing manual using Spectrophotometer type (CTCHROMTECH) and a wavelength of 520 nanometers (Henry *et al.*, 1982, Henry *et al.*, 1974 and Franey and Elias, 1968).

Statistical analysis:

All collected data were analyzed using Excel software. Calculations for the parameters were performed for the all treatments. Data were analyzed using XLSTAT (2004).

Significant differences were reported at 5 percent level among treatments using Duncan's multiple range test (Duncan, 1955).

The statistical model was as follows:

$X_{ij} = \mu + T_i + e_{ij}$.

X_{ij}: observation of the j replicate within i treatment.

μ: overall mean.

T_i: The effect of i experimental treatment.

e_{ij}: experimental error

Results and discussions:

1- Bursa of Fabricius, pancreases and spleen percentage:

As shown in Table (2), the results of the bursa of fabricius were not differ significantly among treatments of males, the highest percentage was (0.12%) for T2 and T4, whereas the percentage of T1 (control) was (0.11%). For female, the same organ was significantly differed (P≥ <0.05), the highest percentage was for both T2 and T3 (0.12%) compared to the value of T1 (control) which was (0.09%). Pancreases percentage showed significant differences (p<0.05) in both sexes, the highest percentage was T2 (0.24%) in male, when compared with T1 (control) (0.11%) was the lowest percentage. In females, the highest percentage of T4 up to (0.26%), whereas the lowest percentage was (0.11%) in T3, whereas T1 (control) was (0.21%). For spleen percentage there were no significant differences in males, the largest percentage was (0.23%) in T3, while the lowest percentage was (0.16%) in T4. In the female, there is a significant improvement (p<0.05), the highest percentage was in T4 (0.23%), while T1 (control) was the lowest percentage (0.14%).

Table 2. Influence of different skip feeding programs on Bursa of Fabricius, Pancreases and Spleen percentage of male and female broiler chicks (Mean ± S.E.)

T.	Percentage					
	Bursa of Fabricius		Pancreases		Spleen	
	Male	Female	Male	Female	Male	Female
T1	0.11 ± 0.01[a]	0.09 ± 0.01[b]	0.11 ± 0.01[b]	0.21 ± 0.01[a]	0.18 ± 0.01[a]	0.14 ± 0.01[b]
T2	0.12 ± 0.01[a]	0.12 ± 0.01[a]	0.24 ± 0.01[a]	0.21 ± 0.03[a]	0.18 ± 0.01[a]	0.17 ± 0.02[b]
T3	0.10 ± 0.02[a]	0.12 ± 0.01[a]	0.16 ± 0.04[ab]	0.11 ± 0.01[b]	0.23 ± 0.04[a]	0.18 ± 0.01[ab]
T4	0.12 ± 0.01[a]	0.09 ± 0.01[b]	0.18 ± 0.01[ab]	0.26 ± 0.01[a]	0.16 ± 0.01[a]	0.23 ± 0.01[a]

Means with different letters within each column are differed significantly (p<0.05)

The findings of our research indicate that considering the immunity of broiler chickens, compared to the Control, bursa of fabricius in females was a significant improvement for skip programs may be the reason is due to the weight gain that occurred in these treatments and between meat-based and not abdominal fat-based increases. Davoodi-Omam *et al.,* (2019) stated that the restriction on feed did not influence the primary lymphoid organs, thymus, and bursa of Fabricius RW. Dissanayake and David, (2017) also recorded a substantial increase in bursa in birds fed 80 percent and 70 percent diet compared with control. Rahimi *et al.,* (2015) had shown that a feed limit of 15 and 30 percent of ad libitum feed intake had a low impact on broiler chicken's immunity.

In feed-restricted broilers fed a supplemented diet in males, we found an increase in pancreatic enzyme activity, which, according to Zubair and Leeson, (1994), perhaps part of the gastrointestinal

change observed following feed restriction; these reports match Pinchasov and Jensen (1989) which confirmed the intermittent feeding was followed by a persistent increase in relative liver weights, pancreas. The weights of the liver, pancreas, and small intestine were significantly increased (p<0.05) due to feeding time limitations. Azis and Afriani, (2019) there were no variations in the weights of internal organs, such as liver, small intestine and pancreas, which increased substantially in broilers with lower feeding time constraints. Palo *et al.*, (1995) these authors determined the pancreatic and intestinal enzyme activity in broilers relating to feed restriction from 7 to 14 d of age or 11 to 14 d of age, and identified an increase in pancreatic enzymes at 14 d of age. The increase in enzyme activity in our study, and in that of Pinheiro *et al.,* (2004), was caused only by feed restriction. The repair of enzyme activity could occur because there was no pancreatic cell death after feed restriction, and instead, only cell atrophy or reduce in protein synthesis occurred in the pancreas (Sans *et al.*, 2004). Pancreatic cells were not assessed in this analysis, but there was likely no atrophy, given that the pancreas weight was greater than control in male chickens after 2 days of re-feeding and smaller than control in female broiler. Feed restriction is known to affect chicken performance, leading to a decrease in body weight and some female organs, such as the pancreas and those of the digestive tract (Camacho *et al.*, 2004; Wijtten *et al.*, 2010). This study also revealed the male that none of the treatments had contributed to the significant development of the immune organ such as spleen. Tumova *et al.*, (2004), in which there were no major differences between ad libitum fed rabbits and feed restriction ones. There were no significant differences (p>0.05) among the treatment media in the relative weights of the spleen. Chen *et al.*, (2012) stated that energy restriction significantly increased the pancreas and spleen ratio in the experiment conducted investigating the effects of a 30 % energy limitation on serum biochemical parameters from 18 to 48 days. There was no considerable difference between the groups treated (p > 0.05) in relative weights of liver, kidneys, spleen, and heart (Yakubu *et al.*, 2009). Both of Fassbinder -Ort h and Karasov, (2006) found no impact of feed restriction of up to 54 percent on the Fabricius and spleen bursa's Range Weight (RW).

2- Hematological parameters:

Table (3) showed the influence of different skip feeding programs factor on Haemoglobin (HB) g/100ml, Packed Cell Volume (PCV) percentage, and Red Blood Cell (RBC) (×106/mm3), in male and female broiler chickens**.** Hemoglobin showed no major differences in males, the highest mean in T1 (control) (11.00), while the lowest mean in T4 (09.33), but Significant differences (p<0.05) were obtained in females, T1 (control) up to (10.67), and although the least average was (08.67) in T4. Packet Cell Volume significantly differed among treatments (p≥0.05) in both sexes. In males, the highest percentage was (32.00%) in T2, which was the lowest percentage (28.33%) in T4, compared to the T1 (control) that was the (31.00%). In the female, the largest percentage was T1 (control) (32.33%), with no difference from others except for T4, which was the lowest percentage (29.00%). No significant differences were found among RBCs percentage in both sexes. In males, the highest mean was (2.40) in T4, which had the lowest mean (2.20) in T3, compared with T1 (control) which was (2.28). In females, the largest mean was T1 (control) (2.37), which had the lowest mean (2.20) in T3.

Table 3. Influence of different skip feeding programs on HB, PCV and RBC of male and female broiler chicks (Mean ± S.E.):

T.	HB (g/100ml)		PCV %		RBC ($\times10^6/mm^3$)	
	Male	Female	Male	Female	Male	Female
T1	11.00 ± 0.57^a	10.67 ± 0.33^a	31.00 ± 0.67^a	32.33 ± 1.20^a	2.28 ± 0.07^a	2.37 ± 0.07^a
T2	10.33 ± 0.33^a	10.00 ± 0.33^{ab}	32.00 ± 0.58^a	31.00 ± 1.00^{ab}	2.26 ± 0.09^a	2.36 ± 0.06^a
T3	10.33 ± 1.20^a	09.67 ± 0.88^{ab}	31.67 ± 0.66^a	30.33 ± 0.33^{ab}	2.20 ± 0.06^a	2.20 ± 0.10^a
T4	09.33 ± 0.33^a	08.67 ± 0.33^b	28.33 ± 1.20^b	29.00 ± 1.00^b	2.40 ± 0.30^a	2.33 ± 0.24^a

Means with different letters within each column are differed significantly (p<0.05)

The hematological parameters of the blood act as indicators of bird physiology (Chowdhury *et al.*, 2005). Compared to the control, Hb and PCV dramatically decrease (p≤0.05), from the findings, we can infer that various skip systems may have some economic benefits with some health threat by declining Hb and PCV values as per the feed restriction regime severity (Abd *et al.*, 2015). Skipping a day's feeding can eventually create more hemoglobin compared to the control. The influence of different feeding on the properties of erythrocytes and observed important improvements in Ht, He, Hb, MCV, MCH, and LEU (Maxwell *et al.*, 1990). No variations in care were noted for the number of red blood cells at the end of the procedure in both sexes, the female groups had significant haemoglobin

(P<0.05). In the full-feed control group, haemoglobin and red blood cell levels were higher than the 1-day skip feed and 2-day skip feed groups. The explanation for that is unclear, Optimal environmental conditions achieved during the experiment would likely have avoided metabolic disorders. Therefore, ascites-based blood parameters have not been determined. Hb level, PCV substantially decreased (P<0.05) in T4, vs T1. (Boostani *et al.*, 2010) that reported a large decrease in the hematocrit content compared to full-fed broilers. That leads to agreements with the results of (Abd *et al.*, 2015). The decline in Hb, PCV, and RBCs is a common phenomenon, since there are many factors including dietary content (Kurtoglu *et al.*, 2005). From our analysis, we indicate that moderate to extreme various skip programs can affect Hb formation in male and female of broilers and this will influence PCV.

Table (4) shows the influence of different skip feeding program factors on White Blood Cells (WBC)s (×1000/mm3), (Heterophil, Eosinophil, and Basophil) percentage in both sexes in broiler chicks. Results of WBCs was not significantly affected by treatments in male, the highest mean was (22.33) in T1 (control), whereas the lowest percentage was in T4 (21.67). Substantial variations (p < 0.05) also found for WBCs in females, the highest mean was (23.33) in T2, with no different from others except T4, which had the lowest percentage (21.00) ×1000/mm3, whereas T1 (control) was (22.67). Heterophil percentage in both sexes showed significant (p≥0.05) differences, in males, the highest percentage was T4 (22.33%) and the lowest percentage was T3 (18.67%), while T1 (control) was (19.66%). In females, the largest parentage represents also in T4 up to (21.36%), whereas the lowest percentage was (18.00%) in T1 (control). The results of Eosinophil percentage were no significant differences among treatments in both sexes. In males the highest percentage was (1.32%) for T2, compared (1.17%) for T3, whereas the percentage of T1 (control) was (1.30%). For females, the largest percentage was (1.66%) in T3, while T2 was the lowest percentage (1.00%), although T1 (control) matched that was (1.33%). Basophil percentage there were no significant differences in both sexes. In males, the largest percentage was (1.67%) in T1 (control), the lowest percentage for T2 reached (1.08%). For females, the highest percentage also was to T1 (control) reached (1.61%), compared with T4 which the lowest percentage (1.17%).

Table 4. Influence of different skip feeding programs on WBC, Heterophil, Eosinophil, and Basophil of male and female broiler chicks (Mean ± S.E.)

T.	WBC (×1000/mm^3)		Heterophil %		Eosinophil %		Basophil %	
	Male	Female	Male	Female	Male	Female	Male	Female
T1	22.33 ± 0.33^{a}	22.67 ± 0.88^{ab}	19.66 ± 0.33^{b}	18.00 ± 0.33^{b}	1.30 ± 033a	1.33 ± 0.33^{a}	1.67 ± 0.33^{a}	1.61 ± 0.32^{a}
T2	22.09 ± 0.33^{a}	23.33 ± 0.33^{a}	18.67 ± 0.33^{b}	19.00 ± 0.33^{ab}	1.32 ± 034a	1.00 ± 0.31^{a}	1.08 ± 0.30^{a}	1.31 ± 0.31^{a}
T3	22.00 ± 0.57^{a}	22.66 ± 0.33^{ab}	20.00 ± 1.00^{b}	19.33 ± 0.67^{ab}	1.17 ± 033a	1.66 ± 0.33^{a}	1.33 ± 0.32^{a}	1.23 ± 0.33^{a}
T4	21.67 ± 0.34^{a}	21.00 ± 0.57^{b}	22.33 ± 0.33^{a}	21.36 ± 1.33^{a}	1.23 ± 031a	1.13 ± 0.30^{a}	1.26 ± 0.31^{a}	1.17 ± 0.32^{a}

Means with different letters within each column are differed significantly (p<0.05)

Regarding the influence of different skip programs on lymphocytes, monocytes, and (H/L Ratio) percentage in both sexes mentioned in Table (5). Lymphocytes percentage showed significant differences (p≥0.05) in males, the highest percentage represent in T4 up to (73.33%) compared with T1 (control) which have the lowest percentage (69.67%). In females, the results showed no significant differences, the largest percentage was T4 (71.76%), the value of T1 (control) was (70.33%) the lowest. The results of monocytes percentage showed no significant differences in both sexes, while in males, the largest percentage was (1.86%) in T1 (control), while the lowest percentage was (1.12%) in T3. In the female, the highest percentage was in T1 (control) and T4 (1.30%), whereas the lowest was (1.23%) in T3. The influence of treatment factor on (H/L Ratio) of male and female, were varying significantly (p<0.05), the largest mean in both sexes were in T4. In the male, the smallest mean was T2, whereas in females the lowest mean T1 (control), in both sexes did not differ from others except T4.

Table 5. Influence of different skip feeding programs on Lymphocytes, Monocytes percentage and (H/L Ratio) of male and female broiler chicks (Mean ± S.E.).

T.	Percentage					
	Lymphocytes		Monocytes		(H/L Ratio)	
	Male	Female	Male	Female	Male	Female
T1	69.67 ± 0.33[b]	70.33 ± 0.33[a]	1.86 ± 0.14[a]	1.30 ± 0.32[a]	0.28 ± 0.003[ab]	0.26 ± 0.001[b]
T2	70.66 ± 0.33[b]	71.34 ± 0.32[a]	1.33 ± 0.33[a]	1.28 ± 0.33[a]	0.26 ± 0.003[b]	0.27 ± 0.001[b]
T3	70.67 ± 0.88[b]	70.33 ± 033[a]	1.12 ± 0.32[a]	1.23 ± 0.32[a]	0.28 ± 0.012[ab]	0.27 ± 0.009[ab]
T4	73.33 ± 0.66[a]	71.67 ± 0.66[a]	1.23 ± 0.33[a]	1.30 ± 0.32[a]	0.30 ± 0.004[a]	0.30 ± 0.016[a]

Means with different letters within each column are differed significantly (p<0.05)

Total of WBC counts were relevant in females (p<0.05), but did not affect males relative to control birds. During the feed restriction, no substantial (p>0.05) difference was found in the White Blood Cell differential counts suggesting that there was no significant stress in birds due to feed restriction (Olukomaiya *et al.*, 2014).The most numerous and frequent form of WBC was the Lymphocytes followed by Heterophils, Eosinophils, and Monocytes. Bounous *et al.*, (2000) noted the same pattern, and identified the lymphocytes as the chickens' most numerous WBC. The WBC in female and lymphocytes in male were significant (p<0.05) also the heterophiles / lymphocytes in both sexes were changed, these changes in the ratio of WBC counts, lymphocytes, and heterophiles / lymphocytes suggest that slow-growing chickens respond to the FR regimen by changing various immune components (Attia *et al.*, 2017). Restriction of feed only risen the LY number (P < 0,05) compared with the control at the end of the experiment (Tůmová *et al.*, 2019). Basophils are essential for histamine and heparin output in circulating blood. Lymphocytes secrete antibodies in body tissues which connect to and mediate its death to foreign microorganisms (Britannica, 2013). Monocytes are successful indirectly killing the pathogens and cleaning up cellular debris from infection sites. Zulkifli *et al*., (2003), suggested that the ratio of Heterophils to Lymphocytes is a valid predictor of avian stress. Broilers exposed to various types of stress displayed a rise in heterophils and a decrease in lymphocytes increasing the H / L ratio (Feddes *et al.*, 2002).

3- Biochemistry parameters:

Table (6) shows the influence of different skip feeding factors glucose, cholesterol, total protein, and uric acid (mg/100ml). The glucose and cholesterol concentration in both sexes treatments were not substantially affected. For males, the highest concentration was (338.67) in T2, whereas the lowest concentration was in T4 (326.34). When compared with T1 (control) was (334). In females, the largest concentration was T3 (336), and the smallest concentration was (333) in T1 (control). Cholesterol concentration in male, was the best concentration for T4 (156.67), whereas the highest concentration in T2 (159.67), while matched per T1 (control) which was (158.67). For females, the better concentration was in T1 (control) (154.33) and the largest concentration was (161.33) at T2. The results for total protein and uric acid in males were no significant differences. In males, the highest concentration of total protein and uric acid was (4.70) in T1 (control) and (4.40) in T4, whereas the lowest concentration in T3 was (4.17) and (3.53) in T1 (control). In females the total protein and uric acid there are varying significantly ($p<0.05$), a maximum concentration was in T2 (4.43), did not differ from others except T3, while the largest concentration in T4 was (4.14) that is different from all treatments.

Table 6. Influence of different skip feeding programs on Glucose, Uric Acid, Total Protein, and Cholesterol) of male and female broiler chicks (Mean ± S.E.):

T	Glucose (mg/100ml)		Cholesterol (mg/100ml)		Total Protein (mg/100ml)		Uric Acid (mg/100ml)	
	Male	Female	Male	Female	Male	Female	Male	Female
T1	334.00 ± 2.08[a]	333.67 ± 4.18[a]	158.67 ± 3.38[a]	154.33 ± 393[a]	4.70 ± 0.35[a]	3.94 ± 0.23[ab]	3.53 ± 0.29[a]	3.07 ± 0.03[b]
T2	338.67 ± 5.81[a]	334.00 ± 1.15[a]	159.67 ± 3.84[a]	161.33 ± 3.18[a]	4.64 ± 0.17[a]	4.43 ± 0.29[a]	3.68 ± 0.32[a]	3.47 ± 0.09[b]
T3	332.33 ± 2.85[a]	336.00 ± 1.53[a]	159.06 ± 3.18[a]	157.67 ± 2.85[a]	4.17 ± 0.14[a]	3.33 ± 0.09[b]	4.27 ± 0.27[a]	3.34 ± 0.24[b]
T4	326.34 ± 8.19[a]	335.00 ± 4.93[a]	156.67 ± 5.60[a]	158.33 ± 4.18[a]	4.20 ± 0.11[a]	4.37 ± 0.33[a]	4.40 ± 0.32[a]	4.14 ± 0.29[a]

Means with different letters within each column are differed significantly ($p<0.05$)

In broiler chickens with increased weight, high development rate needs high energy to create a protein, as the process of creating protein requires energy to complete it, and because glucose is the source of that energy (Van 1999). Hence it is important to get the right glucose needs for birds, so consider that care that increased in body weight improved the glucose ratio (Mench, 2002). This seems to be attributed to the function of the hormone glucagon, which acts on glycogen degradation in the body and releases glucose to use in the body-building protein 's energy and hence weight gain (D'Eath *et al.*, 2009). This is attributable primarily to its fat and cholesterol content that provides a lean meat that can be accomplished through dietary engineering systems, however Shawkat, (2016) showed the effect of different feeding programs no significant effect on cholesterol. There was no dramatic difference ($P>0.05$) in blood cholesterol levels between the treatments restricted for feed and the control. Feeding regime has had a small impact on biochemical and haematological observations of the blood (Tůmová *et al.*, 2019). In feed restricted categories, both the low and high cholesterol values were found than control (Rubel and Beg, 2018). Szabo *et al.*, (2005) reported that there is an indirect proportion between uric acid and protein, indicating that when a high protein level was found, a low uric acid level and vice versa were found. The male no changes in the protein level in this experiment, which means that there is no increase in uric acid, which has been confirmed by this (Shawkat, 2016).

Conclusion:

Summarizing this study demonstrated that a skip every one days in both sexes was a suitable approach for enhancing the percentage of immune organs, with very limited impact on blood variables, and without major effects on biochemical parameters in both sexes except for total protein and uric acid in female broiler chickens.

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تأثير برامج حجب (تصويم) الغذاء المختلفة في الصفات الفسلجية لأفراخ فروج اللحم

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تاريخ الاستلام: 2020/08/01 تاريخ القبول: 2020/09/04

الملخص

هدفت الدراسة إلى تحديد أثر برامج حجب (تصويم) التغذية المختلفة على بعض الأعضاء المناعية وصفات الدم المختلفة في كلا الجنسين لأفراخ فروج اللحم. وزّعت 260 فرخة فروج اللحم، ذكور وإناث على أربع معاملات مختلفة، بواقع خمس مكررات لكل معاملة و13 فرخة لكل مكرر. كانت المعاملات كالاتي: (T1): (معاملة المقارنة) حيث تم توفير الغذاء بشكل مستمر ودائم أمام الطيور. (T2): توفير العلف ليوم واحد وقطعه في اليوم التالي وهكذا حتى عمر 42 يومًا. (T3): توفير العلف ليومين متتاليين ثم قطعه في اليوم الثالث، وهكذا حتى عمر 42 يومًا. (T4): العلف متاح لمدة ثلاثة أيام متتالية، وبقيت الأفراخ بدون علف في اليوم الرابع وهكذا حتى عمر 42 يومًا. حجب التغذية بدأ من عمر 15 يوم لكلا الجنسين. لم تؤثر برامج حجب التغذية المختلفة إيجابياً على كيس الفابريشيوس ونسبة وزن الطحال، في حين أن حجب التغذية بين يوم ويوم قد أدى إلى زيادة نسبة البنكرياس في الذكور. كما لم يكن لبرامج حجب الغذاء المختلفة تأثيراً معنوياً في الهيموغلوبين في الذكور. ومع ذلك، في إناث الطيور وجدت فروقات معنوية عالية ($p\leq0.05$) في كل من حجم خلايا (PCV) وكريات الدم البيضاء. تأثرت الهيتروفيل معنوياً ($p\leq0.05$) في كلا الجنسين، في حين لم يكن لها تأثيراً معنوياً في كريات الدم الحمراء، eosinophil وbasiophil في كلا الجنسين. في المعاملة T4 أظهر الذكور نسبة تعويضية معنوية ($p\leq0.05$) من الخلايا الليمفاوية مقارنةً بالإناث، بينما لم تكن النسبة المئوية للـ monocytes ذات اختلاف معنوي في الذكور والإناث. كان هناك تأثير طفيف لبرامج حجب الغذاء المختلفة في الصفات البيوكيميائية للدم. كما لم يتأثر تركيزا الغلوكوز والكوليسترول لجميع المعاملات لكلا الجنسين، بينما تأثر تركيز البروتين الكلي واليوريا باتباع نظم حجب الغذاء المختلفة عند الإناث فقط.

الكلمات المفتاحية: أفراخ فروج اللحم، حجب الغذاء، صفات الدم والمناعة.