



EFFECT OF FEED RESTRICTION ON GROWTH PERFORMANCE, CARCASS QUALITY, SOME BLOOD PARAMETERS, DIGESTIVE AND PHYSIOLOGICAL INDICES OF MUSCOVY DUCKS

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ABSTRACT: A study was carried out to assess how feed restriction affected the growth performance, carcass characteristics, some blood parameters, digestive and physiological status of Muscovy ducks. A total of one-month old 120 Muscovy ducks were randomly appropriated into 5 groups of 3 replicates with 8 ducks each for a period of 16 weeks of age, both groups were maintained sanitary conditions and similar management practices for the ducks. Birds in the first group were fed *ad-libitum* (control, C), while those in the second (T1), third (T2), fourth (T3) and fifth (T4) groups were fed for 20 h/day, 16 h/day, 12 h/day and 8 h/day, respectively. The obtained results exhibited that, the different periods of feed restriction affected growth performance, dressed carcass, abdominal fat, RBC's, glucose, cholesterol, corticosterone, immunoglobulin A (IgA) and H / L ratio of Muscovy ducks. Feed restriction improved growth performance of feed restricted ducks for 12 or 16 h/d. There was a significant effect ($P < 0.05$) of feeding restriction on blood biochemical and hematological measurements. Feed restriction reduced significantly ($P < 0.05$) abdominal fat, cholesterol, corticosterone and H / L Ratio in the high feed restriction period. Dressed carcass was higher in T2 and T3. However, no significant differences in percentages of digestive organs, thymus or bursa and health status. From the results, it could be concluded that, intermediate feed restriction at the periods of 12 or 16 h/d had a beneficial result on growth performance and carcass fat without any negative effects on physiological or health status in Muscovy ducks.

Key words: Growth performance, feed restriction, Muscovy ducks.

INTRODUCTION

Duck meat is very liked by consumers as it tastes incredible, but the carcass has a higher fat content (Qiao et al., 2017). If diet is obtainable *ad-libitum*, ducks will consume more than twice or three times as much as they need to be maintained (Yang et al., 2025). One of the main approaches for manipulating the growth curve to increase production efficiency, lessen the negative impacts of fast growth, and avoid feed waste in duck production is the use of feed restriction programs (Mulyantini and Lole, 2025). Excessive fat is one of the main problems producers confront, which makes health-conscious consumers see the meat negatively (Qiao et al., 2017). Planned feed limitation has been used in duck production to increase feed efficiency and decrease fat deposition (abdominal and subcutaneous fat) (Fondevila et al., 2020). Feed restriction has been researched as a way to enhance biological and economic performance. Some reports showed that early-age feed-restricted birds did compensate for initial retarded growth and reduce carcass fat in ducks (Bugiwati et al., 2021). Feed restriction results in lower maintenance requirements, which improves the efficiency of a regular ration's dietary nutrients. Feed restriction can be a useful strategy to lower financial losses by lowering the prevalence of skeletal abnormalities, metabolic diseases, and other health issues (Tumova et al., 2022; Azis and Afriani, 2023).

Optimized feeding schedules and other effective management techniques are essential to sustainable and successful duck farming. But in ducks, this growth rate is accompanied by high mortality, ascites, lameness, and increased body fat deposition (Blois, et al., 2019; Ebeid et al., 2022). Many scientists have looked into techniques to reduce the fat in poultry's abdomen and/or carcass (Ibigbami et al., 2021; Falowo et al., 2025). The success of feed restriction protocols, which include physically denying access to feed and water during specific periods of the day, depends on how long the restriction is in place. These protocols leverage the idea of catch-up growth, also

known as compensatory growth (Bordin et al., 2021). Growth is suppressed during the period of feed restriction; however, this can be made up for with increased consumption in the future. Feed limitation can lead to persistent hunger, feeding frustration, increased aggression, and excessive drinking (Van der Klein, et al., 2017). Feed restrictions may also have an impact on the size and function of the digestive tract, which could limit the amount of nutrients that are absorbed for growth (Tumova et al., 2022).

For efficient utilization of feeds, it is crucial to ascertain the optimal performance of ducks throughout various feed restriction periods (Omolola and Olutoye, 2020; Akinsola et al., 2021). Furthermore, evaluating the traits and performance of carcasses with different nutritional profiles may provide valuable data for duck farmers' progress. (Fondevila et al., 2020; Shu et al., 2025). However, this data is restricted to the duck. Therefore, the present study was planned to investigate the effect of feed restriction as a feeding manipulation on the growth performance, carcass characteristics, some blood parameters, digestive and physiological status of Muscovy duck.

MATERIALS AND METHODS

The present study was carried out at private sector at Minia City, Minia governorate, Egypt. All experimental procedures were carried out according to the Local Experimental Animal Care Committee and approved by the ethics of our institutional committee of Department of Animal and Poultry Production, Faculty of Agriculture, Minia University, Minia, Egypt with approval number MU/FA 012/06/25. A total number of one hundred and twenty, one-month old Muscovy ducks were used to investigate the effect of feed restriction on the growth performance, some blood parameters, digestive, physiological status, body temperature and health status of Muscovy ducks. All ducks were wing banded, individually weighed and randomly classified into 5 groups of 3 replicates with 8 ducks each for a period of 16 weeks of age, both groups were raised under almost similar

housing conditions. Birds in the first group were fed *ad-libitum* (control, C), while those in the second (T1), third (T2), fourth (T3) and fifth (T4) groups were fed for 20 h/day, 16 h/day, 12 h/day and 8 h/day, respectively. The birds received unlimited access to feed and clean water throughout the experimental period. The experimental birds were fed on the diet contained adequate levels of nutrients recommended by the National Research Council (NRC, 1994), including 20% crude protein and 3000 kcal/kg till 16 weeks of age.

The measured traits were, body weight (BW, g), body weight gain (BWG, g), feed consumption (FC, g), and feed conversion ratio (FCR, g feed/ g gain). Birds were weighed to the nearest gram and feed consumption at 4, 8, 12 and 16 wks of age. At 16 weeks of age, three birds per group were taken as representative samples and slaughtered. The carcass was manually dissected, and the following criteria were recorded: weights and percentages (of final body weight) of carcass, dressing (carcass weight + giblets weight), and intestinal tract (after removing their contents). Blood samples were collected at slaughter in heparinized tubes. Blood samples for the biochemical parameters were collected from a jugular vein from each slaughtered bird at each slaughtering time. Plasma was separated by centrifugation and stored at -70 °C until analyses were conducted. Total protein (TP, g/dl), albumin (ALB, g/dl), total cholesterol (TC, mg/dl) and glucose concentrations (GLU, mg/dl) were measured. Hematology characteristics, erythrocyte (ER) number, leucocyte (LE) number, lymphocyte (LY) number, neutrophil (NE) number, hemoglobin (HB) and hematocrit value (HC) were analysed, ER number and HC were used to calculate the mean cell volume (MCV). Differential leucocyte counts were determined using the conventional methods. Some health problems such as leg problems (foot pad burns, hock discoloration, soiled cloaca) were recorded. Statistical analysis was conducted using General Linear Model (GLM) procedure (SAS Institute, 2009). Duncan's multiple range test was used to compare between

means wherever significant differences were found (Duncan 1955). The model of analysis was as follow: $Y_{ij} = \mu + T_i + E_{ij}$

Where: Y_{ij} = Observation of the ij^{th} duck μ = The overall-mean, T_i = The effect of treatment, E_{ij} = The random error.

RESULTS AND DISCUSSION

Growth performance: The body weight and gains of ducks (Table 1) was parallel amongst the groups at the first month of feed restriction. The contemporary study examined the growth performance of ducks as influenced by feeding regimens and dietary supplementation with SP. Feed restriction regimens could enhance growth and decrease feed consumption (Shu *et al.*, 2025). At second month of age, body weight (BW) of the restricted ducks was significantly lower than that of the control group. The utmost difference between the restricted and control ducks was detected 12 and 16 weeks of age ($P \leq 0.05$). Data in Table (2), exhibited significant differences ($P \leq 0.05$) in feed consumption (FC) at 4-8, 8-12 and 12-16 weeks of age and feed conversion (FCR) at 8-12 and 12-16 weeks of age for all the experimental groups (C, T1, T2, T3 and T4). In our study, feed restriction reduced feed consumption and body weight gain in ducks compared to those fed *ad-libitum* throughout the period from 4-8 weeks of age. Furthermore, previous research has shown that, in comparison to *ad-libitum* feeding, feed restriction reduces the total body weight gain (Tumova and Chodová, 2018; Livingston *et al.*, 2019; Orso *et al.*, 2019; Ghanima *et al.*, 2023). The reduction in feed consumption detected in this study in restricted groups may be the cause of the observed decrease in body weight gain. Studies have demonstrated a strong correlation between broiler chicken body weight and consumption of feed as well as the period of feed restriction (Abdelraheem *et al.*, 2019). Feed restriction provides the opportunity to take advantage of compensatory growth. Mulyantini and Lole, (2025) found that, the growth performance and carcass of chicken were given feed quantity restrictions were equivalent to *ad-libitum* feeding. The feed conversion and abdominal fat that were given feed

restrictions were significantly lower than those given *ad-libitum* group. In order to stimulate feed efficiency by decreasing the FCR (Gratta et al., 2019), feed restriction programs are typically used in the early stages of a bird's life to induce compensatory growth (Tumova et al., 2022). Fargly et al., (2019) observed that intermittent feeding for four hours and four hours of fasting did not reduce the broiler's growth performance when feed restriction was implemented by feeding time. Similarly, it was shown by Fondevila et al., (2020) that broilers fed less than six hours a day gained body weight at a rate that was comparable to that of broilers fed *ad-libitum*. These results suggest that in order to attain full compensatory growth performance, broilers will probably swiftly adjust to a prolonged restricted feeding regimen (Fondevila et al., 2020). According to a different study by Fondevila et al., (2020), restricting feeding for 4 to 8 hours per day among the ages of 8 and 19 will improve the broiler's anticipatory feeding behaviour and crop development. According to Tumova and Chodova (2018) and Tumova et al., (2021; 2022), feed restriction had no effect on the FCR. Reduced intake of essential amino acids may be the cause of restricted hens' growth rate and feed consumption since it inhibits protein synthesis and promotes proteolysis (Ebeid et al., 2022). Improved nutrient utilization from feed restriction results in compensatory growth during the alimentation period. Prior research verified that in chickens, compensatory growth occurred after restriction (Lunedo et al., 2019). In contrast, Shu et al., (2025) found that the "5+2" feed restriction regimen increased the feed conversion ratio while decreasing the 49-day final body weight, body weight gain, and feed consumption (days 29–49) when compared to *ad libitum* feeding. According to Tůmová et al., (2022), feed restriction as a fixed factor has a substantial impact on chicken growth and feed conversion. According to Falowo et al., (2025), when compared to the unrestricted group, the broiler chickens' final body weight (11.42%), weight gain (11.60%), and feed intake

(11.10%) were all considerably reduced by feed restriction.

Carcass traits and digestive organs: The data presented in Table (3) show the effect of different feed restrictions on carcass traits and digestive organs. Dressed carcass and abdominal fat percent were significantly affected ($P \leq 0.05$) by the different feed restriction systems. The best-dressed carcass and abdominal fat were found in the T3 group (12 h/day) compared to other groups. While, no significant differences were existed in digestive organs. Characteristics of the carcass are crucial to take into consideration while assessing alternate feeding programs. Restricting birds causes giblets to get larger relative to their size, particularly the gizzard, crop, pancreas, and liver, which enhances feed consumption. Restrictions have a major impact on internal organs, and the stomach grow quickly during the realimentation period, as do the other organs (Tůmová et al., 2022). More significant characteristics in ducks are those related to the carcass, such as the quantity and makeup of subcutaneous and abdominal fat. While fatty tissue, particularly in the abdomen, is the main site for fat storage, the liver is the primary site for lipid production (Falowo et al., 2025). Because feed restrictions reduce the liver's metabolic efficiency, the length and severity of the restriction may result in a decline in liver weight. Early feed restriction might reduce the hepatic capacity to produce lipids, which in turn leads to a lower weight of fat around the abdomen. There are two stages involved in the production of body fat and the storage of fat in broilers. Initially, the rate of fat cell multiplication is dominating; later, fat storage becomes increasingly noticeable until the third week of life, when the rate of fat storage takes over. Thus, the reduced rate of lipocyte proliferation may account for the potential for feed restriction to reduce body fat weight. Conflicting accounts exist on this matter, too, as some studies extrapolated the occurrence seen in 42-day-old chicks to a state that might have existed earlier. Azis and Afriani, (2023) informed that, body weight, carcass yield, breast weight, and thigh muscle weight of broilers under feed

time restriction were all considerably lower than those fed *ad-libitum*. Compared to the broilers fed *ad-libitum*, the emptiness of crop and gizzard weights were noticeably higher. Bursa Fabricius's weight increased ($P < 0.05$) when the feeding time was restricted. Nevertheless, not all of the parameters showed any discernible differences. Based on our research, broiler body weight at slaughter age, carcass characteristics, and gastrointestinal and immunological organs were all unaffected by a 4-hour daily feeding restriction (Shu et al., 2025).

Research has shown that live weight and dressing weight are linearly related, with heavier birds resulting in higher dressing and slaughter weights (Banaszak et al., 2021). According to Livingston et al., (2019) and Abdelraheem et al., (2019), broilers under feed restriction had a significantly lower dressing % than those fed *ad-libitum*. Remarkably, when compared to birds fed *ad-libitum*, the relative weights of the internal organs (liver, heart, spleen, and gizzard) increased as a result of restricted feed. This might result from impaired nutrient metabolism brought on by early development's lack of access to sufficient nutrition (Tumova and Chodová, 2018; Tyl et al., 2024). According to research, when broiler feed is restricted, the development of internal organs takes precedence over muscular growth (abdominal fat). When comparing feed-restricted broilers to unrestricted ones, Koçer et al., (2018) found that, the relative weights of internal organs increased significantly. According to Ibigbami et al., (2021), birds on a 40% level and 6 weeks of restriction had the lowest fat content (0.20%), and abdominal fat reduced with increasing period and level of restriction.

According to studies, a restriction regimen increases the weights of the proventriculus and gizzard in order to maintain feed for a longer period of time than *ad-libitum*, which may contribute to improved feed utilization (Fondevila et al., 2020). The microbiota in the intestines is influenced by feed restriction; for instance, the ileum and caecum have higher levels of *Lactobacilleaceae* (Metzler-Zebeli et al.,

2019; Tyl et al., 2024). Additionally, the gut microbial ecosystem is stabilised as a result of the production of lactic acid by *Lactobacillus* species, which inhibits pathogen adherence and proliferation (Ebeid et al., 2022). Orso et al., (2019), on the other hand, found that, the relative weight of the digestive system's organs was often larger during the restriction phase than in the control group. Reduced amino acid intake may be the cause of the decrease in breast yield in broilers subjected to feed restriction (Melo et al., 2021). Furthermore, because there are not as many satellite cells in the pectoralis major muscle, the condition of nutritional stress brought on by feed restriction can result in a decrease in the growth of breast muscle (Ayansola et al., 2023).

Feed restrictions may also have an impact on the size and function of the digestive tract, which could limit the absorption of nutrients necessary for growth. According to Al-Khair et al., (2017), the carcass weight of the broilers that were subjected to a 3–6-hour daily restriction on feeding time between the ages of 8 and 28 days was comparable to that of the control broilers. This study supports a number of others that found no discernible changes in abdomen fat as a result of feed restriction (Farghly et al., 2019; Jahanpour et al., 2020). Saleh et al., (2019) testified that, feed restriction of 70% of *ad-libitum* were able to reduce abdominal fat. According to Tumova and Chodova (2018), gizzard development benefited from feed restriction, and growth increased in the final week of the fattening period. Tumova et al., (2019) found a greater liver proportion and hypothesized that this increase is linked to increased body fat deposition because of increased glycogen storage and functional activity.

Blood parameters and hematology: Significant ($P \leq 0.05$) differences were detected in hematological traits (RBC's, MCV, MCHC) and white blood cell differentiation (lymphocyte, H/L Ratio) and blood constituents (Glucose, cholesterol, corticosterone) and immunoglobulin Levels (IgA) in Tables (4 and 5). Blood constituents are usually indicators of the health status of the poultry. Blood measurements give

information about animal health and metabolism (Ibigbami et al., 2021). Since cholesterol is necessary for the synthesis of hormones and cell membranes, too much of it in the blood can clog arteries and raise the risk of heart disease and stroke. According to Falowo et al., (2025), broilers on the *ad-libitum* (control) diet had considerably greater ($P < 0.05$) RBCs and WBCs as well as lower MCV and MCH than those on restricted diets. However, the concentrations of PCV, Hb, and MCHC across treatments were not substantially impacted by feed restriction ($P \leq 0.05$). Likewise, there was no significant ($P \leq 0.05$) change in PCV, Hb, RBCs, WBCs, MCV, MCH, or MCHC levels in response to supplementing with avocado seed meal. Immunoglobulin G (IgG) and M (IgM) levels were substantially greater ($P \leq 0.05$) in broiler hens on a restricted diet than in those fed an *ad-libitum* (control) diet. Adrenal hypertrophy, sustained elevations in corticosterone secretion following 24-hour restriction or feed-off days, or heightened vulnerability to *Staphylococcus aureus* after 48-hour are examples of adverse physiological effects (Tumova et al., 2019). the comparatively reduced red blood cell (RBC) count seen in broilers that were fed versus those that were exposed to feed restriction. Broilers may experience physiological suffering as a result of this. In a similar vein, feed-restricted broilers' decreased white blood cell (WBC's) count suggests possible immunological challenges throughout production. According to Olukomaiya et al., (2014), good health and regular metabolic rates are frequently linked to higher RBC's and WBC's levels. Remarkably, broilers under feed restriction had a greater mean cell haemoglobin content (MCHC) than broilers fed *ad-libitum*. According to Odunitan-Wayas et al., (2018), MCHC measures the quantity of haemoglobin in relation to the size of red blood cells; this rise may be a sign of a compensating mechanism during feed restriction. According to Ibigbami et al., (2021), serum cholesterol levels considerably decreased ($P < 0.05$) as the amount and duration of restriction increased, while the level and duration of restriction had a

significant effect ($P < 0.05$) on all blood parameters except red blood cells. Albumin, triglycerides, cholesterol, and glucose levels were unaffected by the feeding regimen (Tumova et al., 2019).

Physiology and healthy traits: From data of Table (6), it could be noticed that, there were no significant differences ($P > 0.05$) for lymphoid organs except spleen% while significant differences were observed in health status (Leg problems, plumage conditions, body temperature and mortality rate).

Feed restriction commanded to a reduction in mortality, in the control group compared to that in the treating groups; These results align with those of Tumova et al., (2019) and Tumova and Chodova (2018). Feed restriction reducing the mortality rate and health problems (Tyl *et al.*, 2024). Furthermore, feed restrictions might cause nutritional stress that affects the immunological organs, particularly the bursa Fabricius. According to Jahanpour et al., (2015), quantitative feed restriction for seven days had no effect on the relative weight of immunological organs, while bursa of Fabricius weight decreased after 14 days of 25% and 50% feed restriction. This finding implies that stress, which can increase corticosteroid release and suppress immune cell proliferation, may be the cause of the extreme feed restriction. According to Tumova et al., (2021), feed restriction has a detrimental impact on health effectiveness. Thus, to lessen the severity of feed restriction and stress, a mild feed restriction method such as intermittent feeding or feeding time restriction can be used for a set period of time. Ascites, leg problems, and sudden death syndrome are less common in confined hens, which results in a lower mortality rate (Tumova et al., 2019).

CONCLUSIONS

It could be concluded that ducks restricted-fed diet performed better remarkably, improved feed efficiency and reduce abdominal fat indicating potential trade-offs for producers. So, applying feed restriction regimen for 12 or 16 h/d is highly recommended.

Table (1): Effect of feed restriction on body weight and gains of Muscovy ducks.

Traits	Age (wks)	Treatments					SEM	P value
		C	T1	T2	T3	T4		
Body weight (g)	4	649.2	655.6	645.8	639.8	663.5	29.31	0.1362
	8	1703.5 ^a	1663.1 ^{ab}	1588.8 ^b	1581.5 ^b	1659.3 ^{ab}	53.62	0.0414
	12	2965.3 ^{ab}	2949.2 ^{ab}	2996.7 ^a	3010.2 ^a	2835.4 ^b	89.43	0.0188
	16	3955.1 ^{ab}	3969.9 ^{ab}	4035.8 ^a	4020.6 ^a	3752.3 ^b	96.68	0.0311
Body weight gain (g/bird/day)	4 - 8	37.65 ^a	35.98 ^{ab}	33.68 ^b	33.63 ^b	35.56 ^{ab}	2.27	0.0435
	8 - 12	45.06 ^b	45.93 ^b	50.28 ^a	51.03 ^a	42.00 ^c	2.65	0.0501
	12 - 16	35.35 ^{ab}	36.45 ^a	37.11 ^a	36.09 ^a	32.75 ^b	2.54	0.0326
	Mean	39.35 ^{ab}	39.45 ^{ab}	40.36 ^a	40.25 ^a	36.76 ^b	1.89	0.0395

a-----c Means within row followed by different superscripts are significantly different ($P \leq 0.05$). SEM= standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day).

Table (2): Effect of feed restriction on feed consumption and conversion of Muscovy ducks.

Traits	Age (wks)	Treatments					SEM	P value
		C	T1	T2	T3	T4		
Feed consumption (g/bird/day)	4 - 8	96.94 ^a	96.77 ^a	91.01 ^b	91.35 ^b	86.48 ^c	2.41	0.0152
	8 - 12	152.95 ^a	153.20 ^a	147.22 ^{ab}	142.18 ^b	143.55 ^b	3.39	0.0118
	12 - 16	199.85	201.16	195.19	194.04	196.37	3.81	0.6641
	Mean	149.91 ^a	150.38 ^a	144.47 ^{ab}	142.52 ^{ab}	142.13 ^b	4.15	0.0471
Feed conversion (g feed/g gain)	4 - 8	2.57	2.69	2.70	2.72	2.43	0.10	0.2311
	8 - 12	3.39 ^a	3.34 ^a	2.93 ^b	2.79 ^b	3.42 ^a	0.09	0.0344
	12 - 16	5.65 ^{ab}	5.52 ^{ab}	5.26 ^b	5.38 ^b	6.00 ^a	0.08	0.0191
	Mean	3.87	3.85	3.63	3.63	3.95	0.10	0.6215

a-----c Means within row followed by different superscripts are significantly different ($P \leq 0.05$). SEM= standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day).

Table (3): Effect of feed restriction on carcass traits and digestive organs of Muscovy ducks.

Traits	Treatments					SEM	P value
	C	T1	T2	T3	T4		
I. Carcass traits (Cut parts %):							
Dressed Carcass, %	76.88 ^{ab}	75.44 ^b	77.90 ^a	77.80 ^a	75.27 ^b	0.71	0.0255
Heart, %	0.53	0.55	0.52	0.53	0.50	0.08	0.7141
Liver, %	2.58	2.60	2.49	2.51	2.37	0.29	0.3922
Gizzard, %	2.40	2.43	2.36	2.23	2.15	0.24	0.1068
Abdominal fat, %	5.82 ^a	5.79 ^a	4.92 ^{ab}	4.05 ^b	2.61 ^c	0.25	0.0315
I. Digestive organs, %:							
Gallbladder, %	0.19	0.20	0.18	0.16	0.15	0.03	0.9441
Proventriculus, %	0.61	0.63	0.61	0.62	0.58	0.09	0.2588
Intestine weight, %	4.19	4.22	4.15	3.92	3.75	0.94	0.1551
Intestine length, cm	202.6	204.1	196.9	193.8	188.2	8.71	0.4278
Cecum, %	0.69	0.72	0.68	0.69	0.65	0.11	0.1205
Cecum length, cm	29.45	30.11	28.95	29.11	28.11	0.54	0.9225

a-----c Means within row followed by different superscripts are insignificantly different ($P > 0.05$). SEM= standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day).

Table (4): Effect of feed restriction on hematological parameters of Muscovy ducks.

Traits	Treatments					SEM	P value
	C	T1	T2	T3	T4		
1. Hematological traits:							
RBC's (10 ⁶ /mm ³)	3.04 ^a	2.88 ^{ab}	2.99 ^a	2.90 ^{ab}	2.63 ^b	0.07	0.0189
WBC's (10 ³ /mm ³)	7.29	7.31	7.09	6.89	6.82	0.29	0.1524
Hb (g/dl)	12.05	11.68	11.88	11.39	11.14	0.53	0.7112
HCT (%)	33.51	32.88	33.14	31.12	30.09	0.87	0.4551
PCV (%)	43.24	42.82	42.51	41.89	40.61	2.15	0.1004
MCV(m ³)	135.69 ^b	144.62 ^{ab}	141.00 ^{ab}	145.93 ^{ab}	164.11 ^a	2.89	0.0351
MCH (pg)	39.64	40.56	39.73	39.28	42.36	2.66	0.8451
MCHC (g/dL)	29.21 ^a	28.04 ^{ab}	28.18 ^{ab}	26.91 ^{ab}	25.81 ^b	1.19	0.0501
2. White blood cells differentiation:							
Lymphocyte, %	65.34 ^a	63.82 ^{ab}	65.63 ^a	63.94 ^{ab}	61.35 ^b	0.56	0.0311
Heterophil, %	25.85	25.95	23.12	25.06	26.51	0.78	0.7541
H / L Ratio	0.396 ^{ab}	0.407 ^{ab}	0.352 ^b	0.392 ^{ab}	0.432 ^a	0.00	0.0311

a----b Means within row followed by different superscripts are significantly different ($P \leq 0.05$). SEM= standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day). RBC's: red blood cells count. WBC's: white blood cells count. Hb: hemoglobin. PCV: packed cell volume. MCV: mean corpuscular volume. MCH: mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration (MCHC). (H/L Ratio): Heterophil / Lymphocyte.

Table (5): Effect of feed restriction on blood parameters and immunoglobulin Levels of Muscovy ducks.

Traits	Treatments					SEM	P value
	C	T1	T2	T3	T4		
1. Blood parameters:							
Total proteins (g/dl)	4.21	4.15	3.98	4.06	3.88	0.37	0.9154
Albumin (g/dl)	2.42	2.38	2.31	2.36	2.19	0.26	0.8117
Globulin (g/dl)	1.79	1.77	1.67	1.70	1.69	0.22	0.1662
A: G ratio	1.35	1.34	1.38	1.39	1.30	0.23	0.3651
Glucose (mg/dl)	89.02 ^a	85.01 ^{ab}	88.94 ^a	88.98 ^a	75.03 ^b	3.98	0.0311
Cholesterol (mg/dl)	190.4 ^a	188.9 ^a	171.2 ^{ab}	168.8 ^{ab}	142.3 ^b	10.24	0.0352
AST (IU/ml)	38.61	40.02	36.71	34.92	41.11	4.71	0.2154
ALT (IU/ml)	12.10	11.35	10.95	11.24	13.48	2.41	0.1005
Corticosterone (ng/ml)	38.94 ^{ab}	38.75 ^{ab}	29.24 ^b	29.40 ^b	42.92 ^a	4.82	0.0387
2. Immunoglobulin Levels:							
IgG (mg/dl)	5.38	5.40	5.58	5.61	5.51	0.62	0.1009
IgM (mg/dl)	2.38	2.40	2.44	2.41	2.35	0.39	0.7154
IgA (mg/dl)	1.79 ^{ab}	1.76 ^{ab}	1.93 ^a	1.94 ^a	1.39 ^b	0.17	0.0360

a----b Means within row followed by different superscripts are significantly different ($P \leq 0.05$). SEM= standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day). (A:G) : Albumin/ Globulin ratio. Ig: Immunoglobulin.

Growth performance, feed restriction, Muscovy ducks

Table (6): Effect of feed restriction on health problems of Muscovy ducks.

Traits	Treatments					SEM	P value
	C	T1	T2	T3	T4		
Lymphoid organs:							
Spleen, %	0.261 ^a	0.215 ^{ab}	0.262 ^a	0.258 ^a	0.188 ^b	0.033	0.0184
Thymus, %	0.461	0.455	0.468	0.459	0.432	0.065	0.1057
Bursa, %	0.215	0.199	0.194	0.191	0.209	0.048	0.1714
Health status:							
Leg problems	2.30	2.19	2.06	1.92	1.75	0.74	0.9125
Plumage conditions	2.12	2.06	1.80	1.75	2.18	0.69	0.1921
Body temperature, °C	41.66	41.54	41.41	41.39	41.24	0.59	0.3251
Mortality rate, %	6.67	0.00	3.33	0.00	6.67	0.52	0.1020

a-----b Means within row followed by different superscripts are significantly different ($P \leq 0.05$). SEM: standard error mean. C= control. T1= Restricted feeding ducks (20 h/ day). T2= Restricted feeding ducks (16 h/day). T3= Restricted feeding ducks (12 h/ day). T4= Restricted feeding ducks (8h/day).

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تأثير تحديد الغذاء على اداء النمو, جودة الذبيحة, بعض صفات الدم, ودلائل الهضم والفسولوجي للبط المسكوفى

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الهدف من الدراسة تقييم تأثير تحديد الغذاء على اداء النمو, صفات الذبيحة, بعض صفات الدم, ودلائل الهضم والفسولوجي للبط المسكوفى. تم تقسيم عدد 120 طائر بط مسكوفى عمر 4 اسبوع الى خمسة مجاميع متساوية (كل مجموعة من 3 مكررات بمعدل 8 كتكوت/مكررة). غذيت طيور المجموعة الأولى تغذية حرة (كنترول), بينما غذيت طيور مجموعات المعاملة لعدد ساعات مختلف/يوم. فتم تغذية المجموعة الثانية, الثالثة و الرابعة و الخامسة (معاملة 1, 2, 3 و 4) لمدة 20 ساعة/يوم, 16 ساعة/يوم, 12 ساعة/يوم, و 8 ساعات/يوم على التوالي. أوضحت النتائج المتحصل عليها ان فترات تحديد الغذاء اثرت على اداء النمو, نسبة تصافى الذبيحة, دهن التجويف البطنى, كرات الدم الحمراء, مكونات الدم من الجلوكوزو الكوليسترول والكورتيكوستيرون والالبومين المناعى أ ونسبة الهتروفييل الى الليمفوسيت للبط المسكوفى. تحديد التغذية حسن اداء النمو للبط بمجاميع تحديد الغذاء 16 ساعة/يوم و 12 ساعة/يوم. هناك تأثير قليل لتحديد التغذية على معظم مقاييس الدم والهيماتواوجى. تحديد التغذية قلل دهن التجويف البطنى, الكوليسترول والكورتيكوستيرون و ونسبة الهتروفييل الى الليمفوسيت في مجاميع ذات فترات تحديد تغذية كبيرة. بينما لا يوجد اختلافات معنوية في نسب الأعضاء الهضمية, و التيموثية او البرسا والحالة الصحية. نستخلص مما سبق ان فترات تحديد التغذية المتوسطة (16 ساعة/يوم, 12 ساعة/يوم) لها نتائج مفيدة على اداء النمو, صفات الذبيحة بدون اى تأثيرات عكسية على الحالة الفسولوجية والصحية للبط المسكوفى.