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Performance Characteristics, and Behavior Indices of Broiler Chickens in Response to Color and Form of the Feed

Research Article

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ABSTRACT

Three experiments were conducted to investigate the effect of feed color or feed form on feed preference, growth performance, and behavior indices of broilers. In experiment 1, 60 one-day-old broilers were distributed in 3 vast floor pens whereby broilers of each pen were offered a non-colored feed as well as green, blue, and red colored diets. Broilers preferred to consume higher amounts of green or non-colored feed than those offered with blue and red diets ($P<0.05$) across the entire rearing period. In experiment 2, 240 one-day-old broilers were assigned to one of 4 treatments, comprising five replicates per treatment in a completely randomized design. Dietary treatments included a control (non-colored diet) and diets with blue, green, or red colors. The most significant duration of tonic immobility was observed in broilers fed red feed, while the lowest duration was observed in birds fed blue diet ($P<0.05$). Feeding, preening, and aggressive behavior were higher in birds fed on green feed than those received a control diet ($P<0.05$). In experiment 3, 360 one- day-old chicks were allotted to 6 experimental treatments of a non-colored mash diet; non-colored pelleted feed; non-colored mash + non-colored pelleted diet; non-colored mash + blue color pelleted feed; non-colored mash + green color pelleted feed; and non-colored mash + red color pelleted feed. Broilers fed non-colored pelleted feed had the lowest feed conversion ratio (FCR) during the starter, growing, and entire rearing periods ($P<0.05$). Overall, broilers preferred to consume a colored diet. Feeding pelleted feed improved the growth performance of broilers regardless of feed color.

KEY WORDS behavior, broiler chickens, feed color, feed form, growth performance.

INTRODUCTION

Birds are capable of perceiving visual information in near ultraviolet wavelengths, allowing them to see colors that are beyond the range of human vision (Goldsmith, 2006). Also, it covers various aspects related to birds, including vision, sensory taste, pain reception, evolution, and domestication (Scanes and Dridi, 2021). Trichromatic vision of broiler chickens assists them to see all sections of the visible light spectrum and some ultraviolet (Cornsweet, 1970; Bell and Freeman, 1971). Greenlight suppresses reproductive activity in birds by stimulating retinal photoreceptors, while red light, which activates extra-retinal photoreceptors, appears to speed up reproductive processes (Mobarkey *et al*. 2009). Additionally, simple task of birds could be affected by color which can be used to induce interest in a particular food item (Ham and Osorio, 2007). Therefore, poultry are able to distinguish between colors, memories certain color traits, which have potential to help them improve growth performance through the increased feed consumption (Cooper, 1971). In this regard, Leslie *et al*. (1973) reported that feed color could change the feed consumption during different rearing periods. Cooper (1971) demonstrated that turkeys preferred green color as showed by their readily acceptance of juicy green feed, even when they had not been familiarized with this color. Khosravinia (2007) reported that broiler chickens preferred green lighting as well as green feed over the other lights and feed combinations. In another study, Leghorns preferred blue feed the most and red the least, with red feed significantly decreasing feed consumption (Hurnik *et al.* 1971). Gulizia and Downs (2021) revealed that blue and purple were the most effective colors in improving broiler performance, while other colors had minimal impact. On the contrary, Leslie *et al.* (1973) found that when broiler chicks were given a choice between a non-colored and colored feed, they preferred non-colored diets. Data regarding the effect of feed color on broiler chickens is old and limited although its effect on DFI and growth performance have shown to some extent (Cooper, 1971; Hurnik *et al.* 1971; Khosravinia, 2007). On the other side, information on the effect of feed color on behavioral indices of broiler chickens is limited and needs further research.

In the poultry industry, efforts have been made by producers and nutritionists to enhance growth performance and optimize the cost-effectiveness of production. Feed processing such as grinding (mash diet) or pelleting were shown to improve the feed conversion ratio (FCR) and decrease feed cost of broiler chickens (Amerah *et al.* 2008). McKinney and Teeter (2004) suggested that broilers received pelleted feed had greater body weight and improved FCR compared to broilers received mash feed. It has been shown that pelleted feed beneficially increases feed consumption, decreases feed separation, alleviate feed wastage, improve starch gelatinization, destroy dietary pathogens, and improve palatability of the feed (Preston *et al.* 2000; Jahan *et al.* 2006). While there is substantial literature on the impact of pelleting on broiler chickens, there is limited research on the effects of feeding various forms of feed in combination with feed color. In the first experiment, broilers were expected to show tendency toward a particular feed color. In experiment 2, it was hypothesized that color of the feed might affect behavior of broiler chickens, and in the last experiment we hypothesized that using different feed colors along with form of diet may affect growth performance of broiler chickens. Thus, the objective of these studies were to examine the effect of dietary red, blue, and green colors on feed preference and growth performance of broiler chickens. Also, the effect of feed color along with form of the feed on growth performance of broiler chickens was investigated.

MATERIALS AND METHODS

All experimental procedures were evaluated and approved by the Institutional Animal Care and Ethics Committee of the Islamic Azad University, Isfahan (Khorasgan) Branch. The experiment was conducted according to the regulations and guidelines established by this committee.

Diet Preparation

Dietary color treatments consisted of added non-nutritive human food-grade powdered dyes (Amitida® Co). Control diets had a 0% color dye inclusion. Each dye color (green, blue, and red) was mixed into the basal diet and dispersed using a tumble mixer on feed to ensure a uniform color.

Experiment 1

Birds, housing and feed color preference

Sixty one day-old broiler chicks (Ross 308) were weighed and randomly distributed in 3 floor pens (length 300 cm×width 300 cm) in a power-ventilated house. All chicks were fed in a 3-stage feeding program consisting of starter (1 to 14 d), grower (15 to 28 d), and finisher (29 to 42 d) phases. Broiler chickens of each pen were offered with a non-colored feed as well as green, blue, and red color diets. In this respect, 4 identical, adjacent feeder troughs were located on each side of the pen so that each color of diet was offered in one trough feeder. Diets were formulated to meet or exceed Ross 308 requirements (Aviagen 2014; Table 1). Feed consumption was recorded for pens containing chickens receiving various colors of feed at different periods. Broilers had free access to water and feed during the experiment. The lighting program was 23 h light: 1h darkness during a day. The environmental temperature was set at 33 ˚C for the first week, 30 ˚C for the second week and decreased to 23 ˚C thereafter until the end of the study.

Experiment 2

Birds, management, and data collection

A total of 240 one-day old broiler chicks (Ross 308) were allocated to 4 experimental mash diets with 5 replicates in a completely randomized design during 6 weeks rearing period. Experimental diets included a control non-colored diet, or diets with blue, green, or red colors. All chicks were fed in a 3-stage feeding program consisting of starter (1 to 14), grower (15 to 28), and finisher (29 to 42) phases. Growth performance parameters such as daily weight gain (DWG), daily feed intake (DFI) and feed conversion ratio (FCR) of broiler chickens were determined at different rearing phases. The experimental procedures such as environmental temperature and lighting program were adjusted similar to the first experiment.

Tonic immobility

Tonic immobility was tested on 8 chicks on d 35 from each pen according to the procedure of Campo and Redondo (1996).

Table 1 Dietary composition (%) and nutrients

Item	Starter (1 to 14 d)	Grower (15 to 28 d)	Finisher (29 to 42 d)
Ingredients (g/kg)			
Corn (80 g/kg crude protein)	557.6	599.4	651.9
Soybean meal (440 g/kg crude protein)	384	350	297
Soybean oil	14	12	16
Dicalcium phosphate	18	16	14
Calcium carbonate	10	9	8
DL-Met	3.4	2.7	2.3
L-Lys	2.5	1.4	1.5
L-Thr	1	0.5	0.3
Vitamin premix[1]	2.5	2.5	2.5
Mineral premix[2]	2.5	2.5	2.5
Sodium chloride	2.5	2.5	2.5
$NaHCo_3$	2	1.5	1.5
Calculated nutrient level (as-fed basis)			
ME (kcal/kg)	2850	2900	3000
Crude protein (g/kg)	214	202	183
Lys (g/kg)	13.7	12.1	10.8
Met + Cys (g/kg)	10.3	9.3	8.5
Thr (g/kg)	9.2	8.2	7.4
Ca (g/kg)	9.2	8.2	7.3
Available phosphorous (g/kg)	4.6	4.1	3.7

[1] Vitamin premix provided per kg of diet: vitamin A (retinol): 2.7 mg; vitamin D_3 (cholecalciferol): 0.05 mg; vitamin E (tocopheryl acetate): 18 mg; vitamin k_3: 2 mg; Thiamine 1.8 mg; Riboflavin: 6.6 mg; Panthothenic acid: 10 mg; Pyridoxine: 3 mg; Cyanocobalamin: 0.015 mg; Niacin: 30 mg; Biotin: 0.1 mg; Folic acid: 1 mg; Choline chloride: 250 mg and Antioxidant: 100 mg.

[2] Mineral premix provided per kg of diet: Fe ($FeSO_4.7H_2O$, 20.09% Fe), 50 mg; Mn ($MnSO_4.H_2O$, 32.49% Mn): 100 mg; Zn (ZnO, 80.35% Zn): 100 mg; Cu ($CuSO_4.5H_2O$): 10 mg; I (KI, 58% I): 1 mg and Se ($NaSeO_3$, 45.56% Se): 0.2 mg.

Tonic immobility was induced as soon as a bird was caught by placing the bird on its back with the head hanging in a U-shaped wooden cradle (Bryan Jones and Faure, 1981). The bird was restrained for 15 s. The observer sat in full view of the chicken and at a distance of about 2 m from the bird. If the bird remained immobile for 10 s after the experimenter removed his hands, a stopwatch was started to record latencies until the bird righted itself. If the bird righted itself in less than 10 s, it was considered that tonic immobility had not been induced and the restraint procedure was repeated.

If tonic immobility was not induced after 3 attempts, the duration of tonic immobility was considered to be zero s. If the bird did not show a righting response over the 10-min test period, a maximum score of 600 s was given for righting time.

Behavioral indices

The behavior of the birds was recorded by daily observation of each treatment for 90 min for 16 days giving one complete recording of the 23 light hours of the day by the end of the experiment. At 5-min intervals each bird was classified as feeding, standing, sitting, drinking, foraging, preening, feather ruffling, laying, and aggression.

Experiment 3

Broilers management, experimental diets, and data collection

A total of 360 one day-old chicks (Ross 308) were purchased from a commercial hatchery, weighed, and randomly allocated to 6 experimental diets with 5 replicates and 12 chicks per cage based on a completely randomized design during the starter (1 to 14 d), growing (15 to 28 d) and finisher periods (29 to 42 d). Experimental diets were including anon-colored mash diet (NM); anon-colored pelleted feed (NP); non-colored mash + non-colored pellet (NM+NP); non-colored mash + blue pellet (NM+NP); non-colored mash + green pellet (NM+GP); non-colored mash + red pellet (NM+RP). Data collection for growth performance of broiler chickens were assayed exactly as shown in experiment 2.

Statistical analysis

Before analysis of variance was conducted, the normality of sample data was checked. Because data related to leg indices and tonic immobility were not consistent with the assumptions of normality, they were subjected to the non-parametric analysis of Kruskalwallis test using Xlstat 2014 (Addinsoft, New York, NY). Data for the other recorded traits were subjected to analysis of variance procedures appropriate for a completely randomized design using the General Linear Model procedure of SAS 9.1 (SAS, 2003). The pen was considered as the experimental unit for different parameters.

For all statistical analyses, significance was declared at P ≤ 0.05, unless otherwise stated. The Fisher's protected least significant difference test was used for multiple treatment comparisons. Means were presented with their standard error of means.

RESULTS AND DISCUSSION

As indicated in Table 2, in the starter period chickens were most interested in eating green feed and least interested in red feed (P<0.05). Otherwise, feeding colored diets decreased DFI of broiler chickens across the growing period (P<0.05). During 28 to 42 and 1 to 42 days of age, the consumption of blue and red diets was lower compared to green and non-colored feed (P<0.05).

Effect of dietary treatments on growth performance of broiler chickens in experiment 2 are summarized in Table 3. Broilers fed with green or red diets had greater DFI than chickens received control diet across the growing, finisher and the entire grow-out period (P<0.05). Also, broilers fed on colored diet had greater DWG than birds fed with control diet in which blue and green feed increased DWG across the growing phase (P<0.05) while blue and red diet increased DWG during 1 to 42 days of age (P<0.05). Feeding broilers with red diet decreased FCR compared to control and green feed across 1 to 14 days post-hatch (P<0.05). Also, FCR was lower in birds fed with blue diet than those received green or blue diet across the growing period (P<0.05). Broilers consumed control or blue diet had lower FCR than those fed with blue or green feed across the entire rearing period (P<0.05).

Broiler chickens exhibited the greatest period of tonic immobility when fed with red feed, while those fed a blue diet showed the lowest (P<0.05; Table 4). Sitting and lying of broilers given control diet was greater than birds fed on green diet (P<0.05; Table 5). On the other hand, feeding, preening, and aggressive behavior was higher in birds fed on green feed than those received control diet (P<0.05; Table 5). Similarly, preening and aggressive behavior of birds given red feed was higher than birds fed on control diet (P<0.05; Table 5).

Data on the effect of feed form and feed color on growth performance of broiler chickens are presented in Table 6. Broilers fed on NP had greater DWG than broilers fed with the other experimental diets during 1 to 15 days of age (P<0.05). Feeding broilers with NM decreased DFI across the starter and growing period (P<0.05). Furthermore, DFI of broiler chickens was lower in response to feeding BP + NM diet than those fed on GP + NM feed during 14 to 28 days of age (P<0.05). Across the entire grow-out period, broilers received NP or NM had lower DFI than the other experimental groups (P<0.05). During the starter, finisher and the entire rearing period, the lowest FCR was found in birds fed on NP (P<0.05) while broilers fed on NM had the lowest FCR across the growing period (P<0.05).

During starter and finisher phases of experiment 1, broiler chickens consumed more of green feed than red and blue diets, suggesting that eyesight of avian species is well developed and has the potential to utilize colors as a stimulant to increase feeding response (Hurnik *et al*. 1971). In this respect, Taylor *et al*. (1969) used red, blue and yellow objects in rectangle box to test color preferences of broiler chicks. They observed that chicks preferred red and yellow over blue color. Additionally, birds can readily be trained to distinguish colors (Ueda *et al*. 2005). Moreover, investigations by Ham and Osorio (2007) showed that simple birds' activity such as pecking can be affected by food color. Also, Leslie *et al*. (1973) and Abdelfattah and Farghly (2016) suggested that feed consumption of broilers in different feeding stages can differed by feed color. Khosravinia (2007) showed that broilers consumed more of yellow, red, and green feeds than orange diet. Also, Cooper (1971) offered turkey poults with green and red colored diets and observed that turkey mostly preferred green and red color feeds which is in accordance to the results of the present study. On the contrary, Farghly and Abdelfattah (2017) failed to show any differences in DFI and FCR of turkeys received colored feed. Actually colored diets appear to influence the feed intake of broiler chickens, allowing them to differentiate between favorable and unfavorable diets more effectively.

In the second experiment, feeding broilers with green and red colored diets resulted in greater DFI, suggesting that broiler chickens belong to a group of animal with relatively well developed ability for visual discrimination. Also, broilers fed on colored diet had higher DWG during the growing and the entire rearing periods. It has been demonstrated that different feed colors affect tactile and visual cues of birds with effects on DFI and DWG (Farghly and Mahrose, 2018). Farghly and Abou-Kassem (2014) indicated that broilers fed on green and red diets had significantly greater DWG than broilers fed on non-colored diet which is in accordance with results of this study. On the other hand, findings of Abdelfattah and Farghly (2016) shows that birds received diets with yellow color had significantly higher DWG than those received red, green, and non-colored feeds.

Table 2 Effects of dietary treatments on feed consumption of broiler chickens at different ages (experiment 1)

Daily feed intake	Dietary treatments				SEM	P-value
	Control	Blue	Green	Red		
1-14 d	6.4[bc]	8.2[b]	12.6[a]	4.9[c]	2.10	0.012
14-28 d	26.5[a]	22.7[b]	24.9[b]	22.8[b]	0.78	0.019
28-42 d	40.9[a]	32.1[b]	41.6[a]	25.7[b]	4.33	0.026
1-42 d	44.2[a]	31.4[b]	39.4[a]	26.8[b]	3.95	0.047

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
(n=5).
SEM: standard error of the means.

Table 3 Effects of dietary treatments on growth performance of broiler chickens at different ages (experiment 2)

Parameters	Dietary treatments				SEM	P-value
	Control	Blue	Green	Red		
DFI (g/d)						
1-14 d	27.1	26.7	27.2	26.4	0.56	0.065
14-28 d	89.1[b]	90.0[b]	99.8[a]	97.1[a]	3.54	< 0.001
28-42 d	180.0[b]	184.6[ab]	192.9[a]	189.9[a]	4.93	0.031
1-42 d	92.8[b]	94.7[b]	102.2[a]	100.4[a]	2.84	< 0.001
DWG (g/d)						
1-14 d	22.1	22.5	22.7	22.3	0.45	0.087
14-28 d	68.2[b]	72.3[a]	72.8[a]	70.9[ab]	2.03	<.001
28-42 d	96	99.3	96.1	100.1	2.07	0.090
1-42 d	56.3[b]	58.7[a]	57.9[ab]	58.3[a]	0.89	0.321
FCR						
1-14 d	1.23[a]	1.19[ab]	1.19[a]	1.16[b]	0.014	< 0.001
14-28 d	1.30[ab]	1.25[b]	1.37[a]	1.37[a]	0.05	< 0.001
28-42 d	1.86	1.85	1.95	1.91	0.04	0.084
1-42 d	1.63[b]	1.61[b]	1.76[a]	1.72[a]	0.073	< 0.001

DFI: daily feed intake; DWG: daily weight gain and FCR: feed conversion ratio.
The means within the same row with at least one common letter, do not have significant difference (P>0.05).
(n=5).
SEM: standard error of the means.

Table 4 Effects of dietary treatments on tonic immobility in broiler chickens (experiment 2)

Tonic immobility	Dietary treatments				SEM	P-value
	Control	Blue	Green	Red		
Attempts	0.25	0.3	0.5	0.65	0.21	0.059
Duration (Sec)	70.65[b]	51.55[c]	70.35[b]	79.70[a]	4.51	0.021

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
(n=5).
SEM: standard error of the means.

Table 5 Effects of dietary treatments on behavior indices of broiler chickens (% of total behavior) (experiment 2)

Behavior indices	Dietary treatments				SEM	P-value
	Control	Blue	Green	Red		
Lying	6.91[a]	6.42[ab]	5.13[b]	6.62[ab]	0.87	0.025
Aggressive behavior	0.33[b]	0.79[ab]	1.21[a]	1.54[a]	0.32	0.031
Feather ruffling	2.58[ab]	2.31[c]	3.61[ab]	3.79[a]	0.73	0.043
Preening	1.45[b]	1.60[b]	2.73[a]	2.33[a]	0.36	0.033
Foraging	4.04	4.18	4.66	4.37	0.33	0.067
Drinking	16.83	17.77	16.41	16.29	0.75	0.072
Feeding	36.62[b]	38.55[ab]	40.78[a]	36.46[b]	2.07	0.043
Standing	13.66	12.98	12.54	12.96	0.58	0.061
Sitting	17.45[a]	15.31[ab]	12.99[b]	15.62[ab]	2.21	0.010

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
(n=5).
SEM: standard error of the means.

Table 6 Effects of dietary treatments on growth performance of broiler chickens at different ages (experiment 3)

Parameters	Dietary treatments						SEM	P-value
	NM	NP	NM + NP	BP + NM	GP + NM	RP + NM		
DWG (g/d)								
1-14 d	22.2[c]	27.2[a]	25.2[b]	24.1[b]	24.6[b]	24.0[b]	0.9	< 0.001
14-28 d	68.2	68.8	69.9	67.7	70.3	68.7	1.4	0.120
28-42 d	96.8	100.4	100.0	100.6	102.8	96.2	3.4	0.650
1-42 d	56.4	59.2	59.1	57.9	59.6	57.2	1.7	0.782
DFI (g/d)								
1-14 d	27.1[b]	31.3[a]	32.1[a]	30.6[a]	31.1[a]	30.9[a]	1.9	< 0.001
14-28 d	89.1[c]	100.1[ab]	102.9[ab]	97.4[b]	105.5[a]	99.4[ab]	8.5	< 0.001
28-42 d	180.04	180.39	188.5	187.2	187.8	178.9	19.5	0.520
1-42 d	91.8[b]	93.4[b]	105.4[a]	101.4[a]	103.9[a]	99.3[a]	6.7	0.034
FCR								
1-14 d	1.23[c]	1.15[d]	1.24[bc]	1.27[ab]	1.26[abc]	1.29[ab]	0.02	0.021
14-28 d	1.30[b]	1.46[a]	1.47[a]	1.44[a]	1.50[a]	1.45[a]	0.90	< 0.001
28-42 d	1.86[a]	1.49[b]	1.88[a]	1.86[a]	1.84[a]	1.86[a]	0.18	< 0.001
1-42 d	1.63[b]	1.54[c]	1.76[a]	1.75[a]	1.75[a]	1.74[a]	0.05	< 0.001

NM: non-colored mash diet; NP: non-colored pelleted diet; BP: blue colored pelleted diet; GP: green colored pelleted diet and RP: red colored pelleted diet.
DWG: daily weight gain; DFI: daily feed intake and FCR: feed conversion ratio.
The means within the same row with at least one common letter, do not have significant difference (P>0.05).
(n=5).
SEM: standard error of the means.

Also, Delhey *et al.* (2013) and Egbuniwe and Ayo (2016) reported the greater consumption of yellow feed was because birds saw it like the grains they find naturally, while the higher intake of blue feed was because birds responded more to shortwave UV reflectance. However, Retnani *et al.* (2009) suggested that coloring feed could not affect DWG and final body weight. It has been confirmed that turkey poults prefer green feed more than the other colors or non-colored feed (Farghly and Mahrose, 2018). Also, Serrano *et al.* (2012) found that light color preference of broilers is significantly influenced by age of broilers and session of the day in a same management and environmental conditions.

The longer tonic immobility is an indication of greater stress in broiler chickens (Ale Saheb Fosoul *et al.* 2016). It shows that birds encountered with red color had greater stress while broilers fed blue diet faced with lower stress. It shows that although feeding red colored diet might improve growth performance of broilers but may increase their fear level. In the same trend, preening and aggressive behavior of birds given red and green feeds increased. It shows that the hypothalamically active red color may stimulate interactive behavior because more long wavelength color would have reached the hypothalamus when chicken see them in response to the light reflection (Prayitno *et al.* 1997). In this regard, Prayitno *et al.* (1997) observed that red light increased aggressive behavior, walking, wing and leg stretching in broiler chickens. Bowlby, (1957) believed that red light is attractive for broilers, and this effect is great at the start of the growth period. On the contrary, Kim *et al.* (2014) believed that chickens rest more under the red light.

Our results are in agreement with the findings of Prayitno *et al.* (1997), because the longer time exposure of birds to red color. Sitting and lying of broilers given control diet was greater than birds fed on the other dietary treatments. Prayitno *et al.* (1997) showed that broiler chickens preferred blue over the other lighting colors. Our experiment's data suggests that while feed colors may influence the daily feed intake (DFI) and daily weight gain (DWG) of broiler chickens, birds seem more comfortable with the natural color of the feed. Some colors, such as red, might raise their stress levels. However, further investigations are required to understand the physiological mechanisms involved.

The improvement observed in growth performance of broilers fed on non-colored pelleted feed is associated with beneficial impacts of pelleted diets encompass of increased nutritional density, reduced selective feeding and feed wastage, and less energy spent for feed consumption (Jensen, 2000). Additionally, the stimulatory effect of pellet feeding on feed intake of broilers is an important factor to enhance their growth performance (Engberg *et al.* 2002; Abdollahi *et al.* 2013; Abdollahi *et al.* 2014) suggested that birds feed on pellets and wet forms of feed had the heaviest body weight and DWG in comparison with the birds fed mash and crumbles. Generally, pelleting disrupts the physical structure of diet components, so decrease the required energy for feed consumption and consequently more energy will be available for body growth (Nir *et al.* 1994). Similar to our results, it has been reported that feeding broilers with pelleted diets improved growth rate and feed efficiency of poultry, regardless of cereal type and age of birds (McKinney and Teeter, 2004; Latshaw and Moritz, 2009;

Xu *et al*. 2015). Also, Serrano *et al*. (2012) reported that broilers fed crumbled or pelleted diet had higher DWG than broilers fed with mash diets. On the other side, feed color did not affect growth performance of broiler chickens in this study. Similarly, Leslie *et al*. (1973) failed to find any effect of feed color on growth of broiler chickens. This is in contrast to the work of Cooper (1971) and Hurnik *et al.* (1971) who found that broilers prefer green feed compared to the other colors such as yellow, orange, blue, and red. Also, Cooper (1971) reported that turkey poults gained more weight when fed on diets with green color than those received non-colored feed.

CONCLUSION

Broiler chickens had tendency to use colored feed. Also growth performance was affected by feeding broiler chickens with colored diet. However, feeding broilers with red diet increased fear level and affected their behavior indices such as aggressive behavior, feather ruffling, and preening. On the other hand, growth performance increased in broiler chickens fed on non-colored pelleted feed compared to the other dietary treatments, suggesting that form of the feed has more priority for broilers than the feed color.

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