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Effects of Genetic Strain and Protein Concentrate Removal from Finisher Ration on Performance and Carcass Parameters of Broilers Reared under Hot Climate

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Abstract: The present study was carried out during summer season to examine the response of two broilers strains (RS = Ross 308 and CB = Cobb 500) to protein concentrate removal from finisher diet (28-42 d of age) on performance and carcass parameters. On day 28 of age, a total of 960 birds of two strains were randomly assigned on 32 replicates (16 replicates for each strains) of 30 chicks per replicate. Each replicate consist of 15 males and 15 females for each strain which was distinguished by phenotype. Tow finisher dietary treatments were: (1) the basal diet with protein concentrate supplementation; (2) the basal diet without protein concentrate supplementation were fed for both strains. Body weight (BW) and gain (BWG), feed consumption, feed conversion ratio, mortality and carcass parameters were examined. Results showed that the RS strain achieved greater BW, weight gain and feed consumption than CB strain. While, feed conversion ratio and mortality was not affected by strain. Regardless of strain, results showed that removal of protein concentrate (PC) from finisher ration caused reduction in BW at 35 days and 42 days of age and BWG. The reduction in BWG due to PC removing was 8.15% for 7 days and 18.02% for 14 days. As well as, reduction also occurred in feed consumption and feed conversion ratio from 28 to 42 days of age. In contrast, omitting PC from finisher diets had no effect on carcass yield, breast and thigh meat and abdominal fat pad. In conclusion, the results from this study suggest that 14 days withdrawal of protein concentrate prior marketing have adversely negative effect on performance but not on carcass parameters of both strains of broilers during hot climate.

Key words: Broiler strains, finisher ration, hot climate, performance, protein concentrates removing

INTRODUCTION

During the past several decades, daily body weight gain of broiler increased from 20 g to more than 50 g and feed conversion ratio decreased from 4.1 to 1.7 (Arthur and Albers, 2003). The role of breeding in this success has been dominant, as has been shown by Havenstein *et al*. (1994, 2003). Strain by environment interaction is usually described as a situation in which different strains (breed, lines and strains) respond differently to different environments (Sheridan, 1990). Climate, nutrition and diseases are the most environmental factors affecting poultry production due to modern breeds of broilers have rapid growth which need more comfortable zone, more nutrients input and diseases control to express their genetic potential. Commercial broilers are routinely fed diets contain corn or wheat as main source of cereal grains and soybean meal as a major protein source. Vitamins and minerals (macro and trace) are also used to satisfy the requirements of chicken's nutritional needs (NRC, 1994). Trace minerals and vitamins are needed for all metabolic functions.

Appropriate vitamin and trace mineral supplementation depends on feed ingredients, feed manufacture and local circumstances. In some situations especially in some countries, a package of protein concentrate (PC) is used as a secondary protein source and a source of all vitamins and minerals (macro and trace) with the inclusion rate of PC is 5%. The feed cost is about 70% of production. The cost of PC is about 10% of feed cost, which exceed about two to three times of another ingredient. Therefore, the elimination PC from diet fed to broilers from 4 to 6 weeks of age can reduce feed cost significantly, since approximately of 55% of total feed consumption and 25% of growth are take places in this period (Aviagen, 2012). The elimination PC from ration means removal all vitamins and minerals (macro and trace) and partially caused reduction in critical amino acids (lysine and methionine). Shortage in these amino acids and macro minerals (Ca, P) can be overcome by using synthetic amino acids and limestone or dicalcium phosphate. Although supplementation of vitamins and trace minerals are consist a small part of the total feed cost, their withdrawal from the diet fed during the 7 to 14 day period prior to marketing could reduce production costs significantly. NRC (1994) gives the minimum requirements that are necessary for optimal productivity, whereas, food manufactures use twice to tenfold more of these nutrients recommended as reported by Inal *et al*. (2001). The lack of vitamins and minerals in diet due to omitting vitamin-minerals premix is not issue as

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other ingredients (corn, wheat and soybean and oil) provide a portion of these requirements. Also any deficiency that occurs in some vitamins due to removal, fat-soluble vitamins that sorted in fatty tissue can be mobilized again (Maiorka *et al*., 2002). Removal of vitamins and trace minerals from grower broiler rations for last one or two weeks of marketing age was investigated previously (Skinner *et al*., 1992; Deyhim and Teeter, 1993; Patel *et al*., 1997; Maiorka *et al*., 2002; Khajali *et al*., 2006; Moravej *et al*., 2012) and conflicting results in these articles were founded. Skinner *et al*. (1992) reported that removing vitamin (V) and trace mineral (TM) premixes from broiler diets from 28 to 49 d of age had no adverse growth performance. Razuki *et al*. (2009) found that reduction of protein concentrate packages (PC) to 50% of recommended levels (10%) didn't have any adverse effect on broiler performance. Whereas, Deyhim and Teeter (1993) showed detrimental effect of removal vitamins and trace minerals on weight gain and feed efficiency in birds exposed to high ambient temperatures. Patel *et al*. (1997) found reduction in daily weight gain in three different strains of broilers fed corn-soybean meal diets for 7 days totally deficient from vitamins and minerals, Christmas *et al*. (1995) reported that removing vitamins and trace mineral from broiler feed for two weeks caused reduction in weight gain and feed efficiency but did not in one week period.

Environmental stress in Iraq due to high ambient temperature (HAT) is one of the biggest chronic problems that faced Iraqi broiler producers and breeders. The HAT has been a major factor hindering production of broilers in Iraq, especially, in July and August each year, where a lot of farmer cannot afford costly artificial control of normal ambient temperature in broiler houses due to power issues (electricity cost and unreliable supply) which caused broiler production decrease partially. On the other hand, Ferket and Qureshi (1992) and Ross nutrition supplement (Aviagen, 2009) are found beneficial effects of added excessive vitamins or minerals via feed or in drinking water during heat stress due to increases in vitamins and minerals needs. In view point of our producers, this idea could increased production cost significantly. In Iraq, summer season is more extreme temperature conditions and all broiler strains are imported from countries located in temperate regions (Canada, France, Germany, the Netherlands, the UK and the USA). Therefore, a test of suitable strain that performs better with little cost should be considered. In practice, nutritionists do not take into account the vitamins and trace minerals supplied from the natural feedstuffs. Consequently, the bird's requirements of some nutrients are possibly met from natural feedstuffs as well as body reserves during a short-term vitamin and trace minerals withdrawal (NRC, 1994). Little information is available on the effect of broiler strains reared under suboptimal conditions (heat stress and vitamins and trace minerals withdrawn) on performance. A study under HAT (summer season) was conducted to evaluate two commercial strains of broilers with respect to their performance and carcass composition when PC that contained all vitamins and trace minerals was removed from broiler diets during the period from 28 to 42 days of age.

MATERIALS AND METHODS

Ethics and climates: This study was conducted in accordance with guideline of Canadian Council on Animal care and use of laboratory animals (Olfert *et al*., 1993) and approved by the Office of Agricultural Research Ethics Committee that recently done in Iraq.

Chicks hatched on 16/7/2012 were kept in closed house in poultry station/Office of Agricultural Research. The summer season in Iraq provided the natural hot climate for this study. Temperatures and Relative Humidity (RH) in the center of the house were recorded continuously during the experimental period from 7/8/2012 to 22/8/2012. The temperatures at 0400, 0600, 0800, 1000, 1200, 1400, 1800, 2000 and 2200 h were record on daily basis and were averaged by week (Table 1). These scores are with use the evaporating cooling via pad systems.

Chickens and housing: Unsexed day old straight-run commercial chick of Ross 308 (RS) and Cobb 500 (CB) were used. Newly hatched chicks were reread by thirty-two replicated floor pens were bedded with a wood-shavings litter and equipped with one feeder and one watered. Feed and water were provided *ad libitum*. Lighting maintained continuously throughout the experimental period. The chicks were obtained from two commercial parents stocks that found in Iraq in that time. The parent's age of the strains of Rose 308 (RS) and Cobb 500 (CB) was 53 weeks. On day 28 of age, a factorial arrangement of two strains and two finisher diets (with or without protein concentrate, PC) were conducted throughout the experiment at 42 days of age. Treatment replication consisted of 32 replicates (8 replicates by two dietary treatments by two strains) of 30 chicks per replicate. Each replicate consist of 15 males and 15 females for each strain which distinguish by phenotype.

Feeding and dietary treatment: Chicks were fed *ad libitum* from day to 11 days of age on starter and from 11-28 days of age grower diet fortified with vitamins and trace minerals that supplied from PC. On day 28 of age, all birds fed finisher dietary treatments included (1) the basal ration supplemented with PC and (2) the basal ration with no supplemental PC from 28-42 days of age (Table 2). Finisher dietary treatments (isocaloric and isonitrogenous) were based on corn-wheat-soybean meal diets and prepared at day of initiation of the experiment, with no antioxidant added.

Table 1: Environmental temperature (C°) and relative humidity means (%) during the experimental period

Ages (days)	0400 h (am)	0600 h (am)	0800 h (am)	1000 h (am)	1200 h (pm)	1400 h (pm)	1800 h (pm)	2000 h (pm)	2200 h (pm)
Temperature									
28-35	25.3	25.5	26.6	27.7	28.1	28.3	28.1	28.1	28.1
36-42	24.3	24.4	25.5	26.5	27.0	27.5	27.5	27.5	27.5
Relative humidity (%)									
28-35	42	44	46	48	48	49	50	51	49.1
36-42	43	45	45	49	49	50	50	51	50.8

Table 2: Composition of experimental diets

			------- Finisher 28-42 day of age -------	
Ingredients and composition (%)	Starter 1-10 days of age	Grower 11-28 days of age	With	Without
Yellow corn	38.63	44.06	46.04	47.07
Wheat	20.00	14.50	18.00	16.00
Soybean meal (48% CP)	30.50	30.00	24.50	29.00
Protein concentrate[1]	5.00	5.00	5.00	0.00
Vegetable fat (palm)	3.20	4.50	4.70	4.90
Limestone	1.20	0. 80	0.60	1.00
Dicalcium phosphate[2]	0.90	0.90	0.90	1.60
Salt	0.10	0.10	0.10	0.10
L-Lysine	0.25	0.05	0.07	0.12
DL-methionine	0.22	0.09	0.09	0.21
Total	100	100	100	100
Composition (%)[2]				
ME, Kcal/kg feed	3024	3150	3200	
Crude protein (calculated)	22.50	22.00	20.00	
Crude fat	5.60	6.90	7.30	
Crude fiber	3.50	3.40	3.30	
Lysine	1.43	1.25	1.13	
Methionine+cystine	1.05	0.95	0.85	
Calcium	1.09	0.92	0.84	
Available phosphorous	0.43	0.43	0.42	

[1]Protein concentrate (Wafi B.V. ALBLASSERDAM-Holland) provided per kg: 2150 ME Kcal/kg; 40% crude protein; 4.1% Methionine+Cystine; 3.85% Lysine; 5.6% Calcium; 4.65% Available phosphorous; 5% Crude fat; 2% Crude fiber and other nutrients (vitamins + minerals) exceed the NRC (1994) specifications.

[2]Provided 24% calcium and 18% available phosphorus

Measurements: Chicks were individually weighed at 28, 35 and 42 day of age. BW Gain (BWG) was calculated from 28-35, 35-42 and 28-42 days of age. Feed consumption (FC) and feed conversion ratio (FCR) were determined by pen (replicate) weekly and then summarized in periods from 28-35, 35-42 and 28-42 days of age. FC was adjusted for mortality. Mortality was recorded daily and summarized on a weekly basis. At 42 days of age, 10 birds (5 males and 5 females) per treatment group within each genetic group were selected randomly and fasted overnight (16 h). They were weighed and slaughtered, scalded, picked and eviscerated. Weights of carcass yield (minus giblets and abdominal fat), breast, thigh, drumsticks, wings, back, neck and abdominal fat pad were calculated as a percentage of live body weight.

Statistical analysis: Data of BW and BWG and carcass parameters were subjected three-way analysis of variance with strain, diet and sex as the main effects. The following model was used:

$$Yijkl = \mu+Gi+Dj+Sj+GD(ij)+GS(ik)+GDS(ijk)+eijkl$$

where, Yijk the individual observation; μ = The overall mean; Gi = The strain effect (i = 2); Dj = The diet effect (j = 2); Sj = The sex effect (j = 2); GD(ij) = The strain by diet interaction GS(ij) = The strain by sex interaction; GDS = The strain by diet by sex interaction, eijkl = The random error associated with experimental unit. Correction of body weight due to initial BW at 28 days of age was not conducted due to both strains have significant difference in previous ages.

The FC, FCR and mortality were analyzed as two-way analysis of variance. The following model was used:

$$Yijk = \mu+Gi+Dj+GD(ij)+eijk$$

where, Yijk the individual observation; μ = The overall mean; Gi = The strain effect (i = 2); Dj = The diet effect (j = 2); GD (ij) = The strain by diet interaction; and eijk = The random error associated with experimental unit.

Duncan's multiple range test was used to compare the differences among treatment means. All statistical analysis by General Linear Models (GLM) procedure was carried out with SAS/STAT software (SAS Institute, 1992).

RESULTS

Live performance: The BW and BWG of broiler was significantly influenced ($p<0.0001$) by strain, PC level

Table 3: Influence of strains, protein concentrate removal (PC) and sex of broilers reared under hot climate on body weight (BW) and body weight gain (BWG)[1]

	BW (g)			BWG (g)		
Factor	28 days	35 days	42 days	28-35 days	35-42 days	28-42 days
Strain[2]						
RS	1430.1[a]	1946.8[a]	2473.7[a]	516.1[a]	524.8[a]	1041.7[a]
CB	1376.7[b]	1835.3[b]	2306.9[b]	457.8[b]	470.4[b]	929.1[b]
PC[3]						
With	1405.3	1913.3[a]	2460.8[a]	507.7[a]	546.6[a]	1054.3[a]
Without	1401.5	1868.9[b]	2319.6[b]	466.3[b]	448.1[b]	916.1[b]
Sex						
Male	1497.9[a]	2033.7[a]	2596.6[a]	535.9[a]	561.1[a]	1097.4[a]
Female	1323.4[b]	1769.7[b]	2213.7[b]	445.5[b]	443.2[b]	889.5[b]
Pooled SEM	±5.58	±8.28	±11.4	±7.98	±10.37	±10.85
Source of variation	Probability					
Strain (G)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
PC	0.5091	0.0271	0.0001	0.0170	0.0001	0.0001
G X PC	0.8000	0.9760	0.2951	0.8590	0.3209	0.2664
Sex (S)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
G X S	0.0117	0.0514	0.0418	0.8622	0.5825	0.5462
PC X S	0.9730	0.1792	0.3961	0.2676	0.8503	0.4438
G X PC X S	0.6495	0.5001	0.8972	0.3874	0.5790	0.9900

[a-b]Mean in the same column with no common superscripts differ significantly ($p<0.05$)
[2]RS: Ross 308; CB: Cobb 500. [3]PC: protein concentrate removing

Table 4: Influence of strains and protein concentrate removal (PC) of broilers reared under hot climate on feed consumption, feed conversion ratio and mortality percentage

	Feed consumption (g/bird)			Feed conversion ratio (g feed/g weight gain)			Mortality (%)
Factor	28-35 days	35-42 days	28-42 days	28-35 days	35-42 days	28-42 days	28-42 days
Strain[1]							
RS	968.6[a]	1140.4[a]	2108.9[a]	1.88	2.26	2.07	0.42
CB	907.7[b]	1043.1[b]	1950.7[b]	1.96	2.36	2.17	1.46
PC[3]							
With	947.4	1136.1[a]	2083.5[a]	1.89	2.15[b]	2.02[b]	0.63
Without	928.9	1047.3[b]	1976.2[b]	1.95	2.48[a]	2.22[a]	1.25
Pooled SEM	±13.42	±21.48	±30.09	±0.05	±0.06	±0.04	±0.10
Source of variation	Probability						
Strain (G)	0.0241	0.0154	0.0047	0.1280	0.3020	0.1288	0.1328
PC	0.4661	0.0257	0.0466	0.1675	0.0025	0.0048	0.3608
G X PC	0.2692	0.8441	0.4949	0.5555	0.7402	0.9878	0.3608

[a-b]Mean in the same column with no common superscripts differ significantly ($p<0.05$)
[1]RS: Ross 308; CB: Cobb 500. [3] PC: Protein concentrate removing

and sex. No interaction was occurred between strain and PC as shown in Table 3 which indicates that different strains (RS and CB) showed similar response to the PC levels. Therefore results were presented for main effects only. At 42 days of age, RS strain achieved greater BW (2473.7 g) than CB (2306.9 g) strain. The BWG during period of 28-49 days of age was 1041.7 g for RS compared with 929.1 g for CB strain. Results revealed that RS consumed more feed ($p<0.0001$) than CB, but FCR and mortality was not affected by strain during periods 28-35, 35-42 and 28-42 days (Table 4). There was no significant interaction of strain by PC level on feed consumption (FC) and feed conversion ratio (FCR) (Table 4).

Removal of protein concentrate (PC) from finisher ration caused reduction in BW at 35 and 42 days of age. The reduction in BWG due to PC removing was 8.15% from 28-35 days of age and 18.02% from 35-42 days of age. However, the overall period (14 days) the reduction was 13.11% (Table 3), as well as, reduction were also occurred in feed consumption and feed conversion ratio. Birds fed diet absence from PC during 35-42 and 28-42 days had significantly lower FC and FCR compared with that fed complete finisher diets. There were no significant effects of strain and PC level and interactions on mortality percent during periods 28-42 days of age (Table 4).

Sex was as excepted where male had superior ($p<0.0001$) than females in weight in all situations. Regardless of strain and CP removing, males recorded heavier body weight (2591.6 g) than females (2213.7 g) at 42 days of age (Table 3).

Carcass parameters: For processing parameters, the strain by sex interactions was not significant (Table 5). The carcass yield, thighs, neck, wings, back and abdominal fat was not affected by strain, protein concentrate removing (PC) and sex and their interactions. Breast meat yield was affected by sex and interactions of strain by PC level by sex. The interaction

Table 5: Influence of strains, protein concentrates removal (PC) and sex of broilers reared under hot climate on carcass parameters (%)[1]

	Carcass parameters							
Factor	Carcass[3]	Breast[4]	Thigh	Drumsticks	Wings	Back	Neck	Fat[5]
Strain[2]								
RS	74.74	28.23	10.51	9.90	7.20	16.05	4.84	1.56
CB	74.80	27.71	10.32	9.52	7.34	15.11	5.08	1.48
PC[6]								
With	75.00	27.73	10.65	9.79	7.24	15.47	5.02	1.59
Without	74.72	28.21	10.18	9.63	7.30	15.69	4.89	1.45
Sex								
Male	74.32	27.07^{b}	10.32	9.94^{a}	7.26	15.72	5.05	1.29^{b}
Female	75.39	28.88^{a}	10.51	9.48^{b}	7.27	15.43	4.86	1.75^{a}
Pooled SEM	±0.41	±0.37	±0.13	±0.12	±0.07	±0.25	±0.12	±0.06
Source of variation	Probability							
Strain (G)	0.7795	0.4575	0.4433	0.0990	0.3924	0.0525	0.2891	0.4989
PC	0.7425	0.4930	0.0714	0.4879	0.6679	0.6392	0.5413	0.2423
G X PC	0.9142	0.7765	0.1607	0.6898	0.8158	0.0349	0.1062	0.0496
Sex (S)	0.2129	0.0114	0.4673	0.0473	0.9723	0.5610	0.3859	0.0002
G X S	0.5324	0.6837	0.5859	0.1539	0.4053	0.9133	0.2569	0.5816
PC X S	0.5103	0.9667	0.6912	0.4711	0.6974	0.2688	0.3022	0.1412
G X PC X S	0.2553	0.0160	0.8469	0.8155	0.7466	0.1800	0.4578	0.3646

$^{a-b}$Mean in the same column with no common superscripts differ significantly ($p<0.05$)

[1]Parameters are calculated as percentage of live body weight. [2]RS: Ross 308; CB: Cobb 500

[3]Carcass: Carcass without giblets; [4]Breast: Breast with tender; [5]Fat: Abdominal fat pad; [6]PC: Protein concentrate removing

of strain by PC levels was showed in percentage of fat deposition. Effect of sex was noticed on breast meat, drumsticks and abdominal fat. Females had more relative abdominal fat pad (1.75 vs 1.29%) and breast weight (28.88 vs 27.07%), but lower drumsticks (9.48 vs 9.94%) than males (Table 5).

DISCUSSION

Live performance: Results of this study showed clearly differences in performance of different strain of broilers. These results are consistent with Razuki *et al.* (2011) who showed the same pattern of growth between RS and CB strain that reread under summer season. The present finding are also consistent with Yalcin *et al.* (1997), Razuki (2002), Mehaffey *et al.* (2006), Razuki *et al.* (2007), Abdullah *et al.* (2010), Razuki *et al.* (2011) and Hristakieva *et al.* (2014) who showed that the differences between strains of broilers in BW to be genotype dependent. Likewise, some of strains may superior in some environments but vice versa in another one. Furthermore, differences between strains in their growth at high ambient temperature are related to their genetic potential for growth rate (Cahaner and Leenstra, 1992) and ability of these strains to perform better in hot climate. Results showed that the differences between strains in their performance were dependent upon specific approaches of selection practice that carried out in the pure line and in great grandparents of the commercial broilers. Results of the present study showed that all strain of broilers that imported from cold or temperate regions showed differences in their performance and it is often below of standard level as in company guides when reared in our harsh environment (summer season). However, Korver *et al.* (2004) and Goliomytis *et al.* (2003) could not detect a significant difference between commercial broiler strains for final BW at 42 day of age.

Differences in growth performance between female and male broilers were in agreement with those previously reported by Kidd *et al.* (2005); Lopez *et al.* (2011); Razuki *et al.* (2011); Shim *et al.* (2012). The differences between genders in body weight may be involvement of embryonic androgens in the development of post-hatching sexual dimorphism in BW and may be responsible for differences in embryonic muscle characteristics (Henry and Burke, 1998). Gonzales *et al.* (1998) and Korver *et al.* (2004) reported that the overall FCR of different broiler strains were significantly different. In contrast, Abdullah *et al.* (2010) reported that there was no significant difference in the overall FCR between two strains of broilers. Previous results (Berrong and Washburn, 1998; Razuki, 2002; Razuki and Al-Rawi, 2007; Indarsih and Tamsil, 2012) showed that the FC, FCR and mortality are affected by strain. Deleterious effect on performance was greater and harmful beyond 35 days of age when birds become heavier and couldn't to dissipated internal body heat properly. The summer season in Iraq provide the typical heat stress phenomena (high ambient temperature and low relative humidity) which extent on all day and night even with used evaporative cooling (Table 1).

Removing PC from finisher diets during hot climate caused reduction in broilers performance for both strains. This result was in agreement with Deyhim and Teeter (1993) and Patel *et al.* (1997) who found that the removing vitamins and minerals premix from finisher ration caused reduced WG and feed efficiency. However, Christmas *et al.* (1995) reported that removing vitamins and trace mineral from broiler feed for two weeks caused reduction in weight gain and feed efficiency but

did not in one week period. Maiorka *et al.* (2002) found poor feed conversion due to withdrawal of vitamin mix from finisher rations. Whereas, Skinner *et al.* (1992) found no adverse effect on growth performance due to removing of vitamin (V) and trace mineral (TM) premixes from broiler diets from 28 to 49 d of age. Razuki *et al.* (2009) found that reduction of protein concentrate packages (PC) to 50% of recommended levels (10%) didn't have any adverse effect on broiler performance at various periods of reductions. Abudabos *et al.* (2013) concluded possibility of reduction vitamin-minerals premix up to 50% for 21 days intervals without any adversely effect on performance. The differences in studies are due to more than one reason: (1) increase of broiler requirements due to continuously selection to increase market BW at constant age, (2) expose birds to heat stress (hot vs temperate climate), (3) different management practice (cage or floor litter), (4) different ingredient type used (diet composition).

In view point of broiler producers, excessive vitamin and trace minerals supplementation to broiler diets at hot climate is a major strategy to eliminate heat stress. This study showed that using the normal diets give an acceptable results, consequently, excessive vitamin and trace minerals supplementation could be avoided due to increase in production cost. On the other hand, omitting PC from broiler diets during heat stress as a strategy may inconsistent with animal welfare.

Carcass parameters: The effect of strain on carcass yield was inconsistent with Smith and Pesti (1998), Renden *et al.* (1992), Razuki and Al-Rawi (2007), Olawumi *et al.* (2012) and Shim *et al.* (2012) who showed that the percentage of carcass yield and breast meat were significantly affected by strain. Differences in breast meat between females and males are in agreement with Young *et al.* (2001) and Lopez *et al.* (2011) who reported that breast weight and percentages between females and males were significantly higher. Male broilers had a lower breast meat percentage and higher leg percentage when compared with females (Kidd *et al.*, 2005; Shim *et al.*, 2012). In contrast, Abdullah *et al.* (2010) found that the male have higher breast meat than female.

The effect of strain on fat pad are in agreement with Smith and Pesti (1998) who reported a non significant effect of strain on the percentage of abdominal fat. In contrast, variation in abdominal fat pad weight was observed in different strains. The non significant interaction between strain by sex are similar in those reported by Shim *et al.* (2012).

Removing PC from finisher ration between 28 to 42 days of age had no significant impact on carcass yield and percentages of breast and thighs and secondary carcass cuts and abdominal fat when calculated as a percentage due to cut parts belonged their live weight (Table 5). These findings confirm the results obtained by Maiorka *et al.* (2002) and Khajali *et al.* (2006).

Conclusion: This study showed that removing PC from finisher diets for two weeks interval caused reduction performance of both strains of broilers during hot climate. Percentage of carcass parameters, mostly, was not affected either by strain differences or due to PC omitting. So, It's not recommended to remove or use excessive vitamin in broiler ration in hot climate as a strategy to reduce feed cost or to eliminate heat stress.

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