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Subsequent Effect of Dietary Lysine Regimens Fed in the Starter Phase on the Growth Performance, Carcass Traits and Meat Chemical Composition of Aseel Chicken in the Grower Phase

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Growing phase, growth performance, meat composition, carcass characteristics, Aseel chickens.

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ABSTRACT

This study was designed to examine carryover effect of dietary lysine (Lys) levels fed during the starter phase on the growth performance of three varieties of Aseel chickens. A total of 378 birds (126 from each variety) derived from a previous experiment, in which birds were distributed according a randomized block design in a 3×3 factorial arrangement, were evaluated from 7-18 weeks of age. Treatments consisted of three varieties of Aseel chicken [(Mianwali (MW), Peshawari (PW) and Lakha (LK)] fed three dietary Lys regimes (high, medium and low) during the starter phase (0-6 weeks). In the present experiment, the performance parameters, carcass traits, and meat chemical composition six replicates of seven birds per treatment were evaluated. The MW variety exhibited higher weight gain and better feed to gain ratio (p<0.05). Previous medium dietary Lys regimen improved weight gain, feed to gain ratio, final weight gain (p≤0.05). Birds previously fed medium dietary Lys showed higher thigh dry matter content (p<0.05), and those previously fed low Lys significantly higher thigh crude protein (CP) content (p<0.05). The highest breast muscle CP % were observed birds previously fed the high Lys regime (p<0.05), those of the MW variety (p<0.05). Higher slaughter weight and carcass weight and yield were obtained in the birds previously fed to medium dietary Lys level (p<0.05), and the MW variety showed overall better carcass traits (p<0.05). It is concluded that medium Lys levels in the starter feed promote subsequent better growth performance and that the MW variety has better carcass traits, it may be used as for rural chicken meat production.

INTRODUCTION

The importance of backyard poultry production is well established in tropical and sub-tropical regions, where it is often the main income source, especially of women. Indigenous poultry breeds are a significant of this activity due to their adaptability to harsh climates and high resistance to local environmental pathogens. Aseel is the oldest indigenous breed of Indo-Pak subcontinent, and has five common varieties: Lakha (LK), with of reddish brown plumage and white mottling; Mianwali (MW) with dark brown plumage; Peshawari (PW) with wheaten plumage; Mushki, with black plumage (Babar *et al.*, 2012); and Sindhi, with reddish brown plumage (Rehman *et al.*, 2017).

Aseel chickens have excellent growth potential and reaches its average adult body weight of 4 to 7 kg, which is major reason for the preference of Aseel for farming over the other native breeds (Babar *et al.,* 2012; Usman *et al.,* 2014). Aseel is resilient, surviving in harsh climatic conditions, and has execellent meat-producing qualities (Rajkumar *et al.*, 2016; 2017). These traits make of Aseel an excellent candidate for the production and marketing of organic poultry, in open-sided poultry houses. However, its slow growth rate (20-24 weeks) to achieve market weight (1.5 to 2 kg) is the main obstacle for its widespread production (Jatoi *et al.,* 2014). Unfortunately, this unique bird has been neglected by science and no serious efforts have been made to determine their optimal nutritional and management requirements.

Literature studies that the performance of indigenous chicken can be through improved by nutrition (Tadelle *et al.*, 2003; Kingori *et al.*, 2007). Nutrient optimization and the choice of suitable variety may improve early growth, which might have acceleratory effect on subsequent performance and may help in reducing the market age.

Starting nutrient supply is closely associated with the development of the digestive system of broilers during the starter phase (Beski *et al.*, 2015). Among all amino acids, lysine (Lys) is critical for early growth (Campestrini *et al.*, 2010) and the supplementation of Lys during early growth stages is involved in the regulation of protein synthesis and muscle growth (Eits *et al.*, 2003). The supplementation of Lys during early phase of life improves the subsequent performance of broilers (Kidd *et al.*, 1998). In addition, it has been reported that supplementing 1.4% Lys in starter diets increases intestinal length and the weight of digestive tract (Ullah *et al.*, 2012), and enhances pancreatic enzyme activity and nutrient digestion and absorption (Sklan & Noy, 2000).

However, there is little information on Lys supplementation during the early phase of life of native Aseel chickens. It was hypothesized that the supplementation of Lys in starter diets of Aseel chicks could enhance their subsequent performance and aid reducing market age. Therefore, the present study was designed to examine the carryover effects of Lys supplementation in the starter diet on the growth performance, carcass traits, and meat chemical composition in Aseel chicken during the subsequent phase.

MATERIALS AND METHODS

The study was conducted at Indigenous Chicken Genetic Resource Center, Ravi Campus, University of Veterinary and Animal Sciences (UVAS), Lahore, Pakistan. The experimental procedures complied with the guidelines and code of practice of UVAS, Lahore. Ethical approval was granted before the study was conducted (protocol number UVAS-DAS-4901).

Housing

Birds were housed in three tier multideck battery cages at a stocking density of 1 ft^2 /bird. House equipment was cleaned, washed with potassium permanganate ($KMnO_4$) and sun dried. House fumigation (35mL formalin + 17.5g $KMnO_4$ = 1X concentration) was completed one week before the bird's arrival. House temperature, relative humidity, and lighting schedule were according to those applied in intensive broiler rearing. Water and feed were provided *ad libitum*in nipple drinkers and trough feeders, respectively.

Experimental design

The 378 birds evaluated in the present experiment derived from a previous study, where three different lysine levels (1.35, 1.30 and 1.2%) were used in feed during six weeks (Hussain *et al.*, 2018). In the original experiment, birds were distributed according to a randomized block design in a 3 x 3 factorial arrangement, and were evaluated from 0-6 weeks of age. Sex was used as blocking criterion. The treatments consisted of three Aseel varieties Mianwali (MW), Peshawari (PW) and Lakha (LK) and three Lys levels in the starter diet (low, medium or high, corresponding to 1.25, 1.30, and 1.35% Lys, respectively). In the present experiment, 378 male and female birds, distributed in the same nine treatments, with six replicates of seven birds each, were evaluated from

As the objective of the present study was to evaluate possible carryover effects of dietary lysine levels fed during the starter phase, birds were maintained in the same experimental groups as in the previous study, but were all fed a single grower diet from 6 to 18 weeks of age.

The diet was formulated (Table 1) according to the ideal amino acid concept, and fed. The diet was analyzed dry matter (DM), crude protein (CP), crude fiber, ether extract (EE), ash, calcium and phosphorus contents according to the guidelines of the AOAC (2005). Amino acid content was analyzed using Biochrom 30+ Series Amino acid analyzer (Biochrom Ltd. UK).

Performance parameters

Cumulative feed intake was determined by combining weekly feed intake. Initial and final body weights (FBW) were recorded to calculate the cumulative weight gain. Feed to gain ratio (F:G) and final weight gain and final feed to gain ratio (FF:G) (0 to18 week) were also recorded from day 1 to 18 weeks of age.

Table 1 – Ingredient and nutrients composition of diets*

Ingredients (%)	7-18 weeks
Corn	44
Soybean meal	12.8
Full-fat soybeans	16.5
Rice broken	10
Canola meal	8
Sunflower meal	5
Dicalcium phosphate	0.7
Common salt	0.25
$NaHCO_3$	0.29
CaCO3	1.2
Vit-min premix*	0.5
Lysine sulphate	0.38
DL-Methionine	0.28
L-Threonine	0.1
Nutrients Analysis[1]	
Crude protein (%)	20.5
Metabolizable energy (kcal/kg)	3000
Ca	0.8
Available P	0.4
Dig. Lysine	1.1
Dig. TSAA	0.85
Dig. Threonine	0.75
Dig. Tryptophan	0.22
Dig. Arginine	1.2
Dig. Valine	0.85
Dig. Isoleucine	0.75

[1] Analyzed amino acids is in the range of ±2% of the calculated values *Supplied per kilogram of finished diet: vitamin A (10,00,000 IU/g), 9000 IU; vitamin D3 (500,000IU/g), 3250 IU; vitamin E (500 IU/g), 30 IU; vitamin K3 (43.70%), 4 mg; thiamine (98%), 3.5 mg; riboflavin, 8 mg; B6 (99%), 4.4 mg; B12, (1%) 1.5 mg; folic acid, (95%) 1 mg; B5 calcium-D-pantothenate, (98%) 12 mg; niacin (99.5%), 55 mg; biotin, (2%) 5 mg; choline chloride (60%), 700 mg; Se, (0.4%) 50 mg; Zn (34.01%), 110 mg; Cu (23.67%), 67.2 mg; Fe (30.72%), 394 mg; Mn (32.11%), 172 mg; I (as KI), 0.8 mg; maduramicine, (1%) 50 mg.

Carcass traits and meat chemical composition

In total, 108 birds, two birds per replicate, which BW was close to the average BW of the replicate, were selected to determine carcass traits and meat chemical composition. Birds were fasted for six hours before slaughter. Slaughter weight and carcass weight were determined, and carcasses were cut up to measure breast, thigh, and abdominal fat weights. Carcass yield was calculated as a percentage of slaughter weight, and breast, thigh, and abdominal fat yields as a percentage of carcass weight.

Breast and thigh samples were collected for chemical analyses. Meat dry matter content was determined by drying the samples in a hot air oven at 80°C for 48 hours (Haunshi *et al.*, 2012); crude protein by the Kjeldahl method (AOAC, 1999); ether extract using the Soxhlet apparatus method (AOAC, 1999); and ash was determined by burning the samples in a furnace at 600°C (AOAC, 1999).

Statistical Analysis

Before analysis, data were tested for uniformity and homogeneity (CV) of variance and were verified for the normality (Shapiro-Wilk test). When these assumptions were satisfied, data were submitted to analysis of variance using the GLM procedure of SAS according to the following mathematical model:

$$Yijk = \mu + \beta i + Vj + Lk + (VL)jk + \varepsilon ijk$$

Where, Y_{ijk} is the dependent variable, μ is the overall population mean, βi is the effect of block (sex, V_j is effect of i^{th} treatment (i=3; varieties), L_k is effect of j^{th} treatment (j=3; Lys regimens), $(VL)_{ij}$ is the interaction effect and ε_{ijk} is the residual error. Aseel variety and Lys regimen were taken as main effects, and their interaction was also tested. Treatment means were compared using Tukey's HSD test at 5% probability level. Each replicate was considered as experimental unit.

RESULTS

Growth performance

The statistical analysis showed that Aseel varieties and Lys regimens fed during the starter period had no effect (p>0.05) on the feed intake during the grower phase. However, marked differences (p<0.0001; p=0.0201) in weight gain of different varieties and Lys treatments were observed. Mianwali chickens fed medium Lys levels in the starter phase presented higher weight gain than the other experimental groups. Similarly, both chicken variety and Lys level had significant effect on F:G (p<.0001; p=0.0058). Similar to weight gain, MW birds showed better F:G at medium level of Lys. Aseel varieties and dietary Lys levels also influenced FBW (p<0.0001) and F:G (p<0.0001).Higher FBW and better FF:G were observed in MW birds and those birds fed medium Lys levels in the starter phase dietary treatment. Mortality was similar (p>0.05)among different chicken varieties and dietary Lys level (Table 2).

Carcass traits

Breast weight, breast yield, thigh weight, thigh yield, and abdominal fat were not affected (p>0.05) by previous dietary Lys regimens, but significantly influenced slaughter weight (p=0.0001), carcass weight (p=0.0042) and carcass yield (p<.0001), all of

Table 2 – Weight gain, final body weight, feed conversion ratio and mortality at 18 weeks of age of Aseel chicken varieties fed different dietary lysine regimens during the starter phase.

Variables*		Parameters					
		FI (g)	WG (g)	F:G	FBW (g)	F:G	Mortality (%)
Dietary Treatments							
L1		3431.4±44.9	1172.94±19.1^{ab}	2.94±0.03^{ab}	1624.3±17.9^{a}	2.84±0.04^{b}	0.38±0.12
L2		3432.8±47.3	1195.5±18.5^{a}	2.87±0.03^{b}	1651.8±18.1^{a}	2.81±0.03^{b}	0.33±0.11
L3		3434.5±33.9	1150.5±15.3^{b}	2.98±0.03^{a}	1564.5±15.3^{b}	2.99±0.03^{a}	0.50± 0.12
p-value		0.9987	0.0201	0.0058	<.0001	<.0001	0.6262
Varieties							
LK		3405.3±30.7	1161.5±8.75^{c}	2.94±0.03^{a}	1591.2±10.5^{b}	2.89±0.03^{b}	0.45±0.12
MW		3500.6±47.6	1244.4±15.2^{a}	2.82±0.03^{b}	1696.5±14.8^{a}	2.77±0.03^{c}	0.45±0.12
PW		3392.8±42.3	1113.1±10.4^{b}	3.05±0.02^{a}	1552.8±11.6^{b}	2.97±0.02^{a}	0.34± 0.11
p-value		0.1533	<.0001	<.0001	<.0001	<.0001	0.7644
Varieties × Dietary Treatments							
LK	L1	3421.7±63.9	1147.2±18.1^{bcde}	2.98±0.04^{bc}	1598.4±11.9^{bc}	2.88±0.03^{cd}	0.50± 0.22
	L2	3343.4±53.3	1174.5±15.1^{bc}	2.85±0.03^{de}	1623.0±13.5^{b}	2.79±0.03^{de}	0.34± 0.21
	L3	3450.8±37.8	1162.7±12.4^{bcd}	2.97±0.04^{bcd}	1552.2±17.1^{c}	3.02±0.04^{ab}	0.50± 0.23
MW	L1	3486.7±93	1260.8±23.9^{a}	2.77±0.07^{e}	1713.5±20.5^{a}	2.73±0.07^{e}	0.34± 0.21
	L2	3570.8±95.1	1278.0±27.4^{a}	2.79±0.03^{e}	1741.4±20.7^{a}	2.73±0.03^{e}	0.50± 0.23
	L3	3444.2±61.3	1194.2±15.2^{b}	2.88±0.04^{cde}	1634.5±13.2^{b}	2.86±0.04^{cd}	0.50± 0.23
PW	L1	3385.8±82.7	1110.8±18.9^{de}	3.04±0.03^{ab}	1560.8±13.7^{c}	2.93±0.03^{bc}	0.34± 0.21
	L2	3384.2±70.9	1133.8±17.4^{cde}	2.98±0.04^{bc}	1591.0±14.1^{bc}	2.89±0.04^{cd}	0.17± 0.17
	L3	3408.4±79.6	1094.5±16.9^{e}	3.12±0.04^{a}	1506.7±15.7^{d}	3.08±0.03^{a}	0.50± 0.23
p-value		0.5748	<.0001	<.0001	<.0001	<.0001	0.9539
Linear and Quadratic Responses due to Dietary Treatments							
L		NS	NS	NS	NS	*	NS
Q		NS	*	*	*	NS	NS

[*]LK=Lakha, MW=Mainwali, PW=Pashwari L1=High lysine regimen, L2=Medium lysine regimen and L3=Low lysine regimen [§]FI=feed intake, BWG=body weight gain, F:G= feed to gain ratio, FBW= final body weight, FF:G= final feed to gain ratio

which were higher in the birds previously fed medium Lys levels compared with those fed the low and high Lys levels. All carcass traits were significantly influenced by Aseel chicken variety:slaughter weight (p=0.0001), breast weight (p<.0001), breast yield (p<.0001), thigh weight (p<.0001), thigh yield p<.0001), dressed weight (p<.0001), dressing percentage (p=0.0002) and abdominal fat (p=0.0002). Higher slaughter, carcass, breast, thigh weight and carcass yield were obtained in MW birds, whereas higher abdominal fat, breast and thigh yields were obtained in LK birds. Overall, MW birds showed better carcass traits, while the opposite was observed in PW birds. The interaction between Lys levels and Aseel and varieties were not significant (p>0.05) for any of the evaluated carcass traits (Table 4).

Meat Composition

Meat dry matter content was not significantly different (p>0.05) among Aseel varieties; however, a significant effect (p<0.05)of dietary Lys regimes was detected. The birds fed the medium Lys regimen during the starter period presented higher thigh DM content (p<0.05) at the end of the grower periods compared with those fed the low and high Lys regimes. Breast meat DM content was not affected (p>0.05) by previous Lys regime. There was no interaction between Aseel variety and Lys regime on meat DM content (p>0.05).

A significant interaction (p≤0.05) between Aseel variety and previous Lys regime was detected fort high ash content (%). Higher thigh ash content was observed in PW birds fed the low Lys level during the starter phase. Breast ash content was not influenced (p>0.05) by previous Lys regime; however, LK birds presented higher breast ash content (p≤0.05) compared with the other varieties.

Birds showed differences (p=0.0175; 0.0084) in CP value of thigh due to dietary treatments and interactions while Aseel varieties remained unchanged. Higher CP was found in birds previously fed low Lys. On the other hand, CP content of breast muscles showed differences (p=0.0479; 0.0055) both due to dietary treatments and Aseel varieties, low Lys dietary treatment and PW showed higher CP value. All treatments separately and in interaction showed no pronounced (p>0.05) effects on EE of thigh and breast meat (Table 3).

Table 3 – Carcass traits at 18 weeks of age of Aseel chicken varieties fed different dietary lysine regimens during the starter phase.

Variables*	SW	BW	BY	TW	TY	DW	DP	AF
Dietary Treatments								
L1	1591.2±10.5[b]	199.2±5.1	21.8±0.38	171.5±3.5	18.8±0.26	912.0±10.3[b]	57.4±0.6[a]	1.36±0.03
L2	1696.5±14.8[a]	200.1±5.4	21.5±0.39	175.0±4.0	18.8±0.28	927.6±11.2[a]	54.7±0.4[b]	1.42±0.04
L3	1552.8±11.6[c]	198.7±4.9	22.1±0.41	170.9±3.8	19.0±0.32	900.8±9.2[b]	58.1±0.4[a]	1.35±0.04
p-value	0.0001	0.9261	0.1924	0.2255	0.7424	0.0042	<.0001	0.2312
Varieties								
LK	1624.3±17.9[a]	210.1±2.7[a]	23.2±0.26[a]	180.6±1.8[a]	20.1±0.18[a]	904.7±4.8[b]	55.8±0.5[b]	1.48±0.04[a]
MW	1651.8±18.1[a]	214.5±2.5[a]	22.3±0.12[b]	183.5±2.2[a]	19.1±0.14[b]	961.7±7.8[a]	58.3±0.6[a]	1.35±0.03[b]
PW	1564.5±15.3[b]	173.5±2.2[b]	19.9±0.20[c]	153.3±1.6[b]	17.6±0.16[c]	874.1±4.4[c]	55.9±0.5[b]	1.29±0.02[b]
p-value	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0002	0.0002
p-value VA x DT	0.7944	0.2769	0.2143	0.2783	0.4050	0.6726	0.9749	0.6781

*VA= Varieties, DT, Dietary Treatments, LK=Lakha, MW=Mainwali, PW=Pashwari, L1=High lysine regimen, L2=Medium lysine regimen and L3=Low lysine regimen, SW=Slaughter weight, BW=Breast Weight, BY=Breast Yield, TW=Thigh Weight, TY=Thigh Yield, DW= Dressed Weight, Dp=Dressing Percentage, AF=Abdominal Fat

Value with different superscript within column differ significantly (p>0.05)

Table 4 – Chemical composition of thigh and breast muscles of Aseel chicken varieties fed different dietary lysine regimens during the starter phase.

Variables*		Thigh				Breast			
		DM	Ash	CP	EE	DM	Ash	CP	EE
Dietary Treatments									
L1		74.45±0.30[ab]	1.76±0.06[a]	20.23±0.19[a]	1.98±0.02	73.35±0.23	1.96±0.04	22.30±0.17[b]	1.17±0.03
L2		75.03±0.17[a]	1.59±0.05[b]	19.77±0.17[b]	2.00±0.05	73.28±0.23	1.91±0.04	22.37±0.16[b]	1.21±0.04
L3		74.07±0.18[b]	1.69±0.06[ab]	20.39±0.14[a]	2.06±0.07	73.07±0.24	1.91±0.04	22.81±0.18[a]	1.21±0.03
p-value		0.0176	0.026	0.0175	0.5744	0.6399	0.5042	0.0479	0.6329
Varieties									
LK		74.44±0.26	1.51±0.04[b]	20.24±0.18	2.03±0.05	73.41±0.26	2.02±0.04[a]	22.12±0.12[b]	1.17±0.03
MW		74.41±0.26	1.73±0.06[a]	20.15±0.21	2.01±0.06	73.14±0.21	1.88±0.04[b]	22.51±0.17[ab]	1.18±0.03
PW		74.70±0.19	1.80±0.05[a]	20.00±0.15	2.00±0.05	73.16±0.23	1.87±0.04[b]	22.85±0.19[a]	1.24±0.03
p-value		0.618	<.0001	0.5476	0.9179	0.6134	0.0052	0.0055	0.2314
Varieties × Dietary Treatments									
LK	L1	74.0±0.58	1.58±0.07[bc]	20.72±0.26[a]	1.99±0.05	72.71±0.45	2.08±0.06	22.22±0.12[ab]	1.11±0.03
	L2	75.19±0.24	1.42±0.05[c]	19.46±0.19[b]	1.97±0.08	73.76±0.30	2.08±0.06	21.89±0.15[b]	1.17±0.04
	L3	74.11±0.38	1.52±0.05[c]	20.54±0.24[ab]	2.12±0.06	73.76±0.46	1.89±0.04	22.24±0.31[ab]	1.21±0.04
MW	L1	74.7±0.62	1.71±0.06[abc]	19.60±0.08[ab]	1.97±0.08	73.69±0.38	1.81±0.05	21.95±0.24[b]	1.14±0.04
	L2	74.75±0.38	1.63±0.09[bc]	20.15±0.41[ab]	1.97±0.12	72.91±0.42	1.84±0.05	22.39±0.16[ab]	1.20±0.07
	L3	73.76±0.21	1.87±0.12[ab]	20.69±0.17[ab]	2.10±0.1	72.81±0.20	1.99±0.05	23.19±0.24[a]	1.21±0.04
PW	L1	74.63±0.35	2.00±0.09[a]	20.36±0.29[ab]	1.98±0.10	73.66±0.21	1.97±0.06	22.73±0.42[ab]	1.26±0.05
	L2	75.14±0.28	1.72±0.04[abc]	19.69±0.19[ab]	2.06±0.05	73.16±0.23	1.82±0.06	22.84±0.32[ab]	1.23±0.07
	L3	74.33±0.33	1.68±0.07[abc]	19.95±0.24[ab]	1.96±0.12	72.64±0.33	1.82±0.08	23.00±0.29[ab]	1.21±0.05
p-value		0.6245	0.0391	0.0084	0.6995	0.1410	0.1938	0.0076	0.6397

*LK=Lakha, MW=Mainwali, PW=Pashwari, L1=High lysine regimen, L2=Medium lysine regimen and L3=Low lysine regimen, DM= Dry Matter Cp= Crude Protein EE= Ether Extract

Value with different superscript within column differ significantly (p>0.05)

DISCUSSIONS

Growth Performance

The birds fed medium Lys levels during the starter phase presented better weight gain and feed conversion ratio during the grower phase. It is quite possible that the supplementation of medium Lys level compared may have promoted muscle accretion during the first weeks of growth, resulting in higher final weight gain. The role of Lys in the regulation of protein synthesis and muscle mass accretion during early growth stages has been previously reported (Eits *et al.* 2003; Dozier *et al.* 2007; Campestrini *et al.* 2010). Better feed management early in the life of chicks has significant influence on intestinal tract development, muscular growth and immune system stimulation, ultimately resulting in faster weight gain (Saki, 2005; Prabakar *et al.* 2016) higher early weight gain and market weight (Saki, 2005; Hooshmand, 2006). Higher growth rate later in life has been attributed to the feeding of essential nutrients like carbohydrates, proteins and amino acids early in life, which possibly increases satellite cell proliferation and activity in muscle cells (Kadam *et al.* 2009). Early nutrient supply is linked to development of digestive system, which is faster in the early phase of life (Beski *et al.*, 2015) and intestinal weight is closely related with pancreatic enzyme activity and ultimately, nutrient digestion and absorption (Sklan & Noy, 2000). Hence, chickens had faster growth at a relatively higher dietary Lys concentration in diet compared with diets containing less Lys (Li *et al.,* 2013). Similarly, 14% higher dietary digestible Lys then the commercial recommendations resulted in greater weight gain (Ivanovich *et al.*, 2017). Differences in weight gain and feed conversion ratio were also observed in different varieties of Aseel by Jatoi *et al.* (2014), as well as in feed intake and feed conversion ratio in different varieties of Aseel (Iqbal *et al.*, 2012; Jatoi *et al.*, 2014). Peshawari birds presented significantly higher feed intake compared with those of the Lakha, Mianwali and Mushki Aseel varieties (Usman *et al.* 2013). Higher feed intake was also recorded in Lakha variety (Jatoi *et al.*, 2014). The observed difference in the growth performance among varieties may be the result of genetic diversity (Leeson *et al.,* 1997), as similar kind of variations were also observed in different strains of commercial layers (Scheideler *et al.*, 1998) and of Japanese quails (Jatoi *et al.*, 2013).

Carcass traits

Dietary treatments influenced carcass traits, which is in agreement with previous results showing that carcass yield was not affected by different pre-starter diets (Ullah *et al.* 2012), and opposite to a study that demonstrated that broilers fed high Lys levels in the starter period presented higher fat pad weight and carcass yield than those fed lower Lys levels in the same period (Kidd *et al.*, 1998). The different carcass traits obtained in birds from the different varieties in the present experiments may be due to the fact that these traits may vary among breeds (Mohan *et al.* 2008; Okarini *et al.* 2013), strains (Sogunle *et al.* 2010) and genotypes (Liu *et al.* 2012).

Meat Composition

The findings of the current study confirm that different dietary Lys regimens significantly affect meat dry matter, ash and crude protein contents in indigenous Aseel chicken, which may be the result of incremental levels of amino acids, modifying muscle growth by increasing myofiber size (Dozier *et al.* 2008). The results of the present study show that the lower protein level fed during early growth stages had no adverse effect on meat chemical composition, as opposed to previous studies, which observed that amino acid deficiency can lead to a lower and higher protein and crude fat meat contents, respectively meat (Corzo *et al.* 2005; Lilly *et al.* 2011).

Differences in thigh and breast contents as well as in thigh crude protein contents among the different Aseel varieties might be due to their inherent potential. Similar to our findings, meat ash content differences among different poultry genotypes were reported by Wattanachant *et al.* (2004), who observed lower meat ash contents in Thai chickens compared with commercial broiler strains (Wattanachant, 2008; Sogunle *et al.,* 2010). Difference among the varieties have also been found in some instances (Okarini *et al.,* 2013). Samooel *et al.* (2015) observed significantly higher ash content in the meat chemical composition of yellow-brown plumage color birds.

The chemical composition of Aseel chicken meat is similar to that of broiler meat, with little differences. Previous studies on meat composition showed that Aseel breast and thigh muscles meat contain 26.85 and 24.94% crude protein, 3.75 and 7.13% fat, and 88.28 and 83.35% dry matter (Haunshi *et al.*, 2013). Rajkumar *et al.* (2017) reported 21.5% crude protein, 3.4% fat, 2.0 ash and 73.3% moisture in Aseel breast meat.

CONCLUSIONS

Based on the results of this study, it be concluded that medium Lys levels (1.3%) in the starter diet of the evaluated Aseel varieties promotes better slaughter weight and carcass traits. Moreover, the Mianwali variety has excellent growth potential and may be the better choice as meat type chicken.

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