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Research Article

Effect of Different Dietary Lysine Regimens on Slaughter and Carcass Characteristics of Indigenous Aseel Chicken

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Authors' Contributions
TB did the experiments, collected and analysed the data and wrote the manuscript. NR and AM supervised the experiments. NR proofread the manuscript. AM verified the processed data.

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Aseel varieties, Carcass weight, Carcass yield, Lysine regimens, Pre and post slaughter weight.

Abstract | This study was planned to estimate the effect of different dietary lysine regimens on slaughter and carcass traits in Lakha, Mianwali, Mushki and Peshawari varieties of indigenous Aseel chicken. A total of 240 day-old chicks, 60 from each of the variety were taken randomly and sub-divided equally into three groups (A, B and C). They were offered three lysine regimens i.e., L1 constituting 1.3% lysine from 0-6th week (1-phased) to group A and L2 containing 1.4-1.2 % lysine where 1.4% lysine was offered from 0-3rd week and 1.2% lysine from 4-6th week (2-phased) to group B, while, L3 lysine regimen having 1.5%, 1.3%, 1.1% lysine was offered from 0-2nd, 3-4th and 5-6th week, respectively (3-phased) to group C. These birds were placed in Randomized Complete Block Design (RCBD) with a factorial arrangement of 3(lysine regimens) × 4 (varieties) × 20 (replicates) with one bird in each replicate under standard conditions of house management. For slaughter and carcass characteristics at the age of eighteen weeks, 72 birds including 18 from each variety with 6 from each group were randomly selected and slaughtered. The collected data were analyzed by statistical analysis system (SAS, 9.1) software through factorial Analysis of Variance technique (ANOVA) and means were compared by Duncan's Multiple Range (DMR) test. The findings of this study revealed L3 lysine regimen to be the best for improving the slaughter characteristics including weight of head, shanks, lungs, liver, gizzard, heart, and carcass yield comprising percent weight of breast and thigh.

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Introduction

Poultry farming is renowned for its quick growth, short generation period, higher feed efficiency and biomass per unit area of the land (Mekonnen, 2007). Production rate and cost of production are highly dependent upon nutrition as it covers 75-80 % of the total expenditures. Of this cost of production, 30 % is being paid out on protein as a part of feed (Coon, 2002). The maximum budgetary return could be obtained even from the largest bird if its ration fulfills the requirement for essential amino acids (Mukhtar *et al.*, 2007). Poultry feed mainly constitute cereals grains, which have deficiency of certain amino acids (Smith, 2001). Among these most limiting sulfur amino acids, lysine is the second one after methionine, inevitable to be used in feed formulation (Ahmad *et al.*, 2007). Lysine is used as reference amino acid for other sulfur amino acids while creating "ideal balance" and is mainly concerned as enhancer for growth and carcass (Corzo *et al.*, 2002). Mbajiorgu *et al.* (2011) reported that lysine resulted in maximum weight gain when used as supplement in protein feed. Lysine is mandatory for gaining ideal weight, feed efficiency and is also required for improving breast meat as it represents 60 percent of edible protein of broiler meat (Barboza *et al.*, 2000; Labadan *et al.*, 2001). Though, amino acids are the basic requirements for muscle growth and lysine part in breast muscle is generally higher than

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Table 1A: Composition of experimental diets for Aseel birds

Ingredients	Dietary lysine levels (%)				
	1.1	**1.2**	**1.3**	**1.4**	**1.5**
Corn	59.08	59.08	59.08	59.08	59.08
Sunflower Meal (24%)	18.9	18.9	18.9	18.9	18.9
Soya bean Meal (44%)	7.04	7.04	7.04	7.04	7.04
Rapeseed Meal	3	3	3	3	3
Fish Meal (52%)	3	3	3	3	3
Poultry by-product Meal	3	3	3	3	3
Molasses	3	3	3	3	3
Limestone	1.14	1.14	1.14	1.14	1.14
Lysine Sulphate	0.7	0.9	1.1	1.3	1.5
Mono Calcium Phosphate	0.45	0.45	0.45	0.45	0.45
Vitamin-Mineral Premix*	0.2	0.2	0.2	0.2	0.2
Sodium Chloride	0.18	0.18	0.18	0.18	0.18
Alimet (Novus)	0.17	0.17	0.17	0.17	0.17
Betaine HCl	0.05	0.05	0.05	0.05	0.05
Threonine	0.04	0.04	0.04	0.04	0.04

*Vit-Min premix supplied per 1 kg of diet: Vit. A 12000 IU; Vit. D3 2200 ICU; Vit. E 10 mg; Vit. K 32 mg; Vit. B1 1 mg; Vit. B2 4 mg Vit. B6 1.5 mg; Vit. B12 10 Ug; nicotinic acid 20 mg; folic acid 1 mg; pantothenic acid 10 mg; biotin 50 Ug; choline chloride 500 mg; copper 10 iron 30 mg; manganese 55 mg; zinc 50 mg; iodine 1 mg; selenium 0.1 m

any other amino acid. The inadequacy of lysine in feed has been found to be involved in reduced breast meat yield than other body muscles, thus its supplementation for perfect improvement of muscles and meat yield is of supreme importance (Tang *et al.*, 2007). Under the increasing threat of socio-economic issues concerning the bird's welfare as is caused by intensive farming, there is an emerging trend towards the diversification and versatility of poultry production systems like free range or pasture feeding (Sundrum, 2001). In spite of the fact that customers are of the will to pay low costs for poultry meat, they are progressively being attracted towards products that they see as naturally created or ecologically well supportive and well balanced with the welfare of the birds (Fanatico *et al.*, 2007). The utilization of commercially available strains is being discouraged for welfare issues and chickens with a moderate growth rate are favored for broad production systems. They demonstrate "natural" interactive patterns with full benefit of broad rearing systems and are more adaptable, whereas the rapidly growing meat type chicken portray a very low level of adjustment and resistance towards the natural habitat (Fanatico *et al.*, 2008). In spite of a high retail cost than traditional poultry products, these sorts of chicken have raised active attention in state markets. The local breeds of chicken are also being given attention and are being well-maintained in many countries of the world especially due to their unique carcass and meat quality traits (Zanetti *et al.*, 2010). There is an increasing trend towards the native breeds since the last decade as the conservation of biodiversity has become the most important challenge for the international scientific community (FAO, 2009). The indigenous Aseel of Pakistan is unique in its physique and stamina to be equally adaptable in all sorts of environments (Sing, 2001) and is an excellent source of animal protein but its rearing is getting less important due to high inputs and low production potential (Batool, 2017). Keeping in view the importance of Aseel chicken and lysine amino acid, a study was planned to enhance the initial growth and the carcass quality characteristics of indigenous Aseel varieties following their supplementation with different dietary lysine regimens.

Materials and Methods

The present experiment was conducted at Indigenous Chicken Genetic Resource Center (ICGRC), Ravi Campus, Pattoki, UVAS, Lahore, by keeping in view the standard instructions for the care and welfare of the experimental birds and the ethical permission was granted by the concerned university before the conduction of this study. For this experiment, 240 day-old chicks including 60 from each of the four varieties i.e., Lakha, Mianwali, Mushki and Peshawari, were arbitrarily selected and divided into three sub-groups A, B and C, with 20 birds in each. These birds were offered three lysine regimens i.e., L1 constituting 1.3% lysine from 0-6th week in one phase to group A, and L2 containing1.4-1.2 % lysine, where 1.4% lysine was offered from 0-3rd week and 1.2% lysine from 4-6th week in two phases to group B, while, L3 lysine regimen having 1.5%, 1.3%, 1.1% lysine was offered from 0-2nd, 3-4th and 5-6th week, respectively in three phases to group C (Composition of lysine regimens is mentioned in Table 1A and B).

Table 1B: Calculated values of nutrients.

	Dietary lysine level %				
	1.1	**1.2**	**1.3**	**1.4**	**1.5**
Metabolize Energy(k calories/kg)	2746.99	2753.69	2760.39	2767.09	2773.79
Dry Matter	87.17	87.36	87.56	87.76	87.96
Crude Protein	17.06	17.18	17.29	17.40	17.51
Crude Fiber	6.93	6.93	6.93	6.93	6.93
Ash	4.09	4.09	4.09	4.09	4.09
Either Extract	3.59	3.59	3.59	3.59	3.59
Calcium	0.84	0.84	0.84	0.84	0.84
Chloride	0.22	0.22	0.22	0.22	0.22
Sodium	0.16	0.16	0.16	0.16	0.16
Total phosphorus	0.68	0.68	0.68	0.68	0.68
Potassium	0.71	0.71	0.71	0.71	0.71
Digestible phosphorus	0.36	0.36	0.36	0.36	0.36
Linoleic Acid	1.42	1.42	1.42	1.42	1.42
Lysine	1.1	1.2	1.3	1.4	1.5
Methionine	0.45	0.45	0.45	0.45	0.45
Methionine+Cystine	0.78	0.78	0.78	0.78	0.78
Digestible Arginine	0.98	0.98	0.98	0.98	0.98
Digestible Tryptophan	0.14	0.14	0.14	0.14	0.14
Digestible Threonine	0.57	0.57	0.57	0.57	0.57
Digestible Lysine	0.99	1.09	1.20	1.31	1.41
Digestible methionine	0.42	0.42	0.42	0.42	0.42
Digestible Methionine + Cystine	0.67	0.67	0.67	0.67	0.67
Threonine	0.67	0.67	0.67	0.67	0.67
Tryptophan	0.19	0.19	0.19	0.19	0.19
Arginine	1.10	1.10	1.10	1.10	1.10
Cystine	0.32	0.32	0.32	0.32	0.32
Digestible Cystine	0.26	0.26	0.26	0.26	0.26
Valine	0.82	0.82	0.82	0.82	0.82
Digestible Valine	0.71	0.71	0.71	0.71	0.71
Histidine	0.43	0.43	0.43	0.43	0.43
Digestible Histidine	0.37	0.37	0.37	0.37	0.37
Phenylalanine	0.78	0.78	0.78	0.78	0.78
Digestible Phenylalanine	0.67	0.67	0.67	0.67	0.67
Leucine	1.44	1.44	1.44	1.44	1.44
Digestible Leucine	1.21	1.21	1.21	1.21	1.21
Isoleucine	0.66	0.66	0.66	0.66	0.66
Digestible Isoleucine	0.58	0.58	0.58	0.58	0.58

The experimental feed was formulated and analyzed as per NRC (1996) and AOAC (2005) guidelines, respectively. These birds were placed under Randomized Complete Block Design (RCBD) with a factorial arrangement of 3(lysine regimens) × 4(varieties) × 20(replicates) with one bird in each replicate. Afterwards, all these birds were equally offered the normal broiler grower feed having 20.5% CP and 3000kcal/kg metabolizable energy. At the end of eighteenth week, 72 birds including 18 birds from each of the four varieties with 6 birds from each treatment group were randomly taken to evaluate the slaughter and carcass traits. These birds were subjected to fast for twelve hours and then were weighed to calculate the pre-slaughter weight and then slaughtered according to Halal Muslim method (Fuseini *et al.*, 2016). These birds were then defeathered and their head and shanks were separated

Table 2: Effect of lysine regimens, Aseel varieties and their interactions on selected slaughter parameters.

Parameters /Variables		Pre-slaughter/ final Live Body weight (g)	Post-slaughtered weight (g)	Carcass weight (g)	Carcass yield (% of BW)	Head weight (g)	Shanks weight (g)
Lysine (%)/Regimens							
1.3 (L1)		1540.04±40.57^{b}	1457.10±42.58^{b}	1140.58±28.12^{b}	74.32±1.00^{c}	52.83±1.50^{b}	53.96±1.44^{c}
1.4-1.2 (L2)		1583.00±45.64^{b}	1533.85±43.35^{b}	1229.79±27.81^{b}	78.11±0.96^{b}	58.96±1.44^{a}	66.71±1.28^{b}
1.5-1.3-1.1 (L3)		1794.21±57.91^{a}	1704.50±55.02^{a}	1461.33±48.10^{a}	81.50±0.72^{a}	60.50±1.34^{a}	79.63±2.24^{a}
Aseel Varieties							
Lakha		1618.28±78.59	1539.45±77.33	1279.06±56.54	79.60±1.37	62.56±0.96^{a}	69.56±3.08^{ab}
Mianwali		1616.06±74.07	1539.98±71.25	1244.56±63.21	76.98±1.30	57.33±2.21^{b}	70.33±3.12^{a}
Mushki		1669.67±45.89	1596.18±43.29	1297.89±44.16	77.63±1.04	55.06±1.95^{b}	64.89±3.61^{bc}
Peshawari		1652.33±42.28	1584.99±39.37	1287.44±45.39	77.71±1.24	54.78±1.33^{b}	61.94±2.29^{c}
Lysine Levels (%)/Regimens × Aseel Varieties							
1.3 (L1)	Lakha	1509.33±129.02^{bc}	1410.12±133.66^{bc}	1139.17±62.67^{c}	76.56±2.75^{bcd}	60.17±1.22^{abcd}	58.50±1.28^{c}
	Mianwali	1450.00±39.54^{c}	1361.67±47.89^{c}	1046.00±22.64^{c}	72.22±0.93^{d}	47.83±2.37^{f}	61.17±1.45^{bc}
	Mushki	1563.00±65.14^{abc}	1484.85±61.89^{abc}	1168.17±25.62^{c}	75.06±1.60^{cd}	53.50±3.70^{def}	45.83±0.83^{d}
	Peshawari	1637.83±63.24^{abc}	1571.78±65.76^{abc}	1209.00±81.09^{bc}	73.43±2.26^{d}	49.83±1.78^{ef}	50.33±1.89^{d}
1.4-1.2 (L2)	Lakha	1619.33±120.20^{abc}	1568.37±114.19^{abc}	1275.83±69.57^{abc}	79.48±2.42^{abc}	63.50±1.28^{ab}	65.33±3.26^{bc}
	Mianwali	1544.33±91.03^{abc}	1497.12±86.48^{abc}	1183.17±32.19^{c}	77.40±2.79^{abcd}	66.17±1.45^{a}	65.83±2.02^{bc}
	Mushki	1635.50±92.29^{abc}	1583.73±92.29^{abc}	1283.73±87.68^{bc}	76.19±0.97^{bcd}	50.83±0.83^{ef}	69.83±3.27^{b}
	Peshawari	1532.83±73.82^{abc}	1486.19±70.13^{abc}	1215.50±54.06^{bc}	79.39±0.91^{abc}	55.33±1.89^{cde}	65.83±1.45^{bc}
1.5-1.3-1.1 (L3)	Lakha	1726.17±164.96^{abc}	1639.86±156.71^{abc}	1422.17±125.81^{ab}	82.75±1.41^{a}	64.00±2.13^{ab}	84.83±3.16^{a}
	Mianwali	1853.83±168.10^{a}	1761.14±159.70^{a}	1504.50±130.57^{a}	81.31±0.59^{ab}	58.00±2.90^{bcd}	85.00±6.42^{a}
	Mushki	1810.50±47.32^{ab}	1719.98±44.96^{ab}	1480.83±64.15^{a}	81.63±1.62^{ab}	60.83±3.69^{abc}	79.00±1.97^{a}
	Peshawari	1786.33±47.93^{abc}	1697.02±45.54^{ab}	1437.83±68.72^{ab}	80.31±2.02^{abc}	59.17±1.62^{abcd}	69.67±2.43^{b}
Source of Variation			**P-Value**				
LR		0.0011	0.0018	<.0001	<.0001	0.0002	<.0001
AV		0.8877	0.8348	0.8250	0.3221	0.0015	0.0033
LR × AV		0.1139	0.1250	0.0002	0.0012	<.0001	<.0001

Values have been mentioned as Mean±SEM and various superscripted alphabets show significant (*P≤0.05*) differences among them (order of significance is as: a>b>c…….)

from the main body to measure the dressed weight, whereas, skin was kept intact for supporting the internal organs. The selected slaughter and carcass traits i.e., post slaughter weight (g), carcass weight (g), carcass yield (percent of final live body weight), head, shanks, liver, gizzard (filled with and empty from contents) and heart weight (g) were calculated. The intestinal weight (g) and intestinal length (cm) was also measured. Among carcass traits, neck weight as well as breast and thigh yields were taken as percent of carcass weight. The collected data were analyzed by SAS software through factorial ANOVA and results were expressed as means and their standard errors. The treatment means were compared by Duncan's Multiple Range (DMR) test (Duncan, 1955) and were considered as significant at P≤0.05.

Results

The present study showed increased (P≤0.05) pre-slaughter (1794.21±57.91g), post-slaughter (1704.50±55.02g), carcass (1461.33±48.10g) and head (60.50±1.34) weights of Aseel birds in L3 (1.5-1.3-1.1%) than L2 (1.4-1.2%) and L1 (1.3%) lysine regimens (Table 2). Whereas, significantly (P≤0.05) highest weights of shanks (79.63±2.24g), liver (41.92±1.17g), filled gizzard (55.88±1.24g), empty gizzard (44.58±0.90g) and heart (14.04±0.28g) were observed in L3 followed by L2 and L1 lysine regimen (Table 2-3). Among visceral organs, intestinal length (137.67±0.71cm) and weight (57.04±2.10g) were comparatively higher in L3 followed by L2 and L1 lysine regimen (Table 2). Carcass yield (81.50±0.72% of live

body weight), Neck (5.72±0.08%), breast (34.03±0.77%) and thigh (17.15±0.25%) percent to carcass weight too showed significantly (P≤0.05) highest value in L3 followed by L2 and L1 lysine regimen (Table 4). Among varieties, Lakha showed a significantly (P≤0.05) greater head (62.56±0.96g) and intestine (61.28±2.48g) weight than Mianwali, Mushki and Peshawari varieties. Likewise, Mianwali variety depicted a significantly (P≤0.05) greater shanks (70.33±3.12g), liver (41.94±1.17g), neck (4.90±0.24% of carcass) and thigh (16.50±0.27 % of carcass) weight than other three varieties (Table 2, 3, 4).

As far as results of interactions among lysine regimens and Aseel varieties are considered, Mianwali showed higher pre-slaughter (1853.83±168.10g), post-slaughter (1761.14±159.70g), carcass (1504.50±130.57g), shanks (85.00±6.42g), weight and neck (5.99±0.09%), thigh (17.69±0.44%) yields with L3 lysine regimen. Lakha variety showed a greater carcass yield (82.75±1.41%), shanks (84.83±3.16g), filled gizzard (56.33±2.03g) and heart (15.17±0.17g) weight, while, Peshawari showed a higher liver (45.33±1.63), gizzard (58.33±1.20, 47.83±0.87 filled with and empty from contents, respectively) weight (g) and breast yield (37.02±0.58% of carcass weight) with L3 regimen (Table 2, 3, 4).

Table 3: Effect of lysine regimens, Aseel varieties and their interactions on weight (g) of Heart, Liver, Gizzard, Intestine and Intestinal length (cm).

Parameters /Variables		Heart	Liver	Gizzard (filled)	Gizzard (Empty)	Intestine	Intestinal length
Lysine levels (%)/Regimens							
1.3 (L1)		7.08±0.50^{c}	32.67±1.31^{c}	38.13±0.86^{c}	26.75±0.54^{c}	50.83±1.67^{b}	134.71±3.53
1.4- 1.2 (L2)		10.00±0.40^{b}	37.71±1.42^{b}	46.71±1.71^{b}	34.67±1.22^{b}	56.42±2.61^{ab}	135.79±3.90
1.5- 1.3- 1.1 (L3)		14.04±0.28^{a}	41.92±1.17^{a}	55.88±1.24^{a}	44.58±0.90^{a}	57.04±2.10^{a}	137.67±0.71
Aseel Varieties							
Lakha		10.56±0.97	36.44±2.04^{b}	47.89±2.46	36.61±2.15	61.28±2.48^{a}	137.11±2.71
Mianwali		10.61±0.78	41.94±1.17^{a}	47.11±2.02	34.72±1.79	53.39±2.86^{b}	137.61±3.55
Mushki		9.94±0.76	33.78±1.42^{b}	45.89±2.24	34.44±1.96	52.67±2.47^{b}	130.89±3.26
Peshawari		10.39±0.80	37.56±1.70^{b}	46.72±2.54	35.56±2.31	51.72±1.81^{b}	138.61±4.31
Lysine level(%)/Regimens × Aseel Varieties							
1.3 (L1)	Lakha	5.50±0.43^{f}	28.17±0.83^{d}	37.00±1.73^{c}	26.33±1.17^{ef}	54.50±1.23^{bcd}	126.83±3.13^{cde}
	Mianwali	6.83±1.14^{ef}	41.17±1.47^{a}	37.67±1.93^{c}	26.00±1.03^{f}	41.50±3.38^{e}	125.00±6.23^{de}
	Mushki	8.67±1.05^{de}	28.83±1.14^{cd}	39.33±0.80^{c}	27.50±0.89^{ef}	50.00±2.11^{cde}	137.67±2.97^{bcd}
	Peshawari	7.33±0.95^{ef}	32.50±2.46^{cd}	27.17±1.35^{c}	27.17±1.35^{ef}	57.33±2.30^{abc}	149.33±9.82^{ab}
1.4-1.2 (L2)	Lakha	11.00±0.26^{c}	41.50±2.13^{a}	50.33±3.93^{ab}	39.17±2.98^{bc}	67.00±1.65^{a}	148.50±4.15^{ab}
	Mianwali	11.50±0.22^{bc}	42.50±3.22^{a}	50.33±1.58^{ab}	36.17±1.19^{cd}	66.50±2.28^{a}	152.83±2.79^{a}
	Mushki	7.67±0.33^{e}	32.00±1.86^{cd}	42.83±3.05^{bc}	31.67±2.19^{de}	46.50±4.56^{de}	115.33±4.99^{e}
	Peshawari	9.83±0.98^{cd}	34.83±1.45^{bc}	43.33±4.00^{bc}	31.67±2.09^{de}	45.67±3.29^{de}	126.50±6.22^{cde}
1.5-1.3-1.1 (L3)	Lakha	15.17±0.17^{a}	39.67±4.05^{ab}	56.33±2.03^{a}	44.33±1.52^{ab}	62.33±6.51^{ab}	136.00±0.73^{bcd}
	Mianwali	13.50±0.43^{ab}	42.17±1.14^{a}	53.33±2.79^{a}	42.00±1.98^{b}	52.17±1.99^{bcd}	135.00±1.53^{bcd}
	Mushki	13.50±0.85^{ab}	40.50±1.15^{ab}	55.50±3.51^{a}	44.17±2.12^{ab}	61.50±3.54^{ab}	139.67±1.17^{abcd}
	Peshawari	14.00±0.37^{a}	45.33±1.63^{a}	58.33±1.20^{a}	47.83±0.87^{a}	52.17±1.89^{bcd}	140.00±1.06^{abc}
Source of Variation				**P-Value**			
LR		<.0001	<.0001	<.0001	<.0001	0.0704	0.7889
AV		0.7433	0.0008	0.8321	0.4913	0.0220	0.4093
LR × AV		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Values have been mentioned as Mean±SEM and various superscripted alphabets show significant (*P≤0.05*) differences among them (order of significance is as: a>b>c……).

Table 4: Percent effects of lysine regimens, Aseel varieties and their interactions on carcass yield (% of body weight) **and weight (% of carcass weight) of Neck, Breast and Thigh.**

Parameters/Variables		Carcass	Neck	Breast	Thigh
Lysine (%)/Regimens					
1.3 (L1)		74.32±1.00^{c}	3.17±0.15^{c}	24.03±0.41^{c}	14.87±0.15^{c}
1.4-1.2 (L2)		78.11±0.96^{b}	5.05±0.11^{b}	29.67±0.75^{b}	15.66±0.19^{b}
1.5- 1.3- 1.1 (L3)		81.50±0.72^{a}	5.72±0.08^{a}	34.03±0.77^{a}	17.15±0.25^{a}
Aseel Varieties					
Lakha		79.60±1.37	4.57±0.30^{ab}	29.17±1.05	15.42±0.35^{c}
Mianwali		76.98±1.30	4.90±0.24^{a}	28.62±1.18	16.50±0.27^{a}
Mushki		77.63±1.04	4.68±0.30^{ab}	29.81±1.34	15.61±0.25^{bc}
Peshawari		77.71±1.24	4.43±0.32^{b}	29.38±1.42	16.05±0.36^{ab}
Lysine (%)/Regimens × Aseel Varieties					
1.3 (L1)	Lakha	76.56±2.75^{bcd}	2.91±0.21^{f}	25.01±1.10^{fg}	14.45±0.17^{f}
	Mianwali	72.22±0.93^{d}	3.69±0.06^{e}	23.33±0.53^{g}	15.62±0.19^{cde}
	Mushki	75.06±1.60^{cd}	3.30±0.43^{ef}	24.33±0.73^{fg}	14.79±0.26^{def}
	Peshawari	73.43±2.26^{d}	2.79±0.23^{f}	23.47±0.84^{g}	14.61±0.33^{ef}
1.4-1.2 (L2)	Lakha	79.48±2.42^{abc}	5.32±0.18^{abcd}	32.39±1.98^{bcd}	14.52±0.04^{f}
	Mianwali	77.40±2.79^{abcd}	5.02±0.13^{cd}	29.24±1.02^{de}	16.17±0.26^{c}
	Mushki	76.19±0.97^{bcd}	5.11±0.29^{bcd}	29.38±1.67^{de}	15.74±0.15^{cd}
	Peshawari	79.39±0.91^{abc}	4.75±0.23^{d}	27.65±0.60^{ef}	16.21±0.44^{c}
1.5-1.3-1.1 (L3)	Lakha	82.75±1.41^{a}	5.49±0.18^{abc}	30.11±0.55^{cde}	17.28±0.41^{ab}
	Mianwali	81.31±0.59^{ab}	5.99±0.09^{a}	33.27±1.68^{bc}	17.69±0.44^{a}
	Mushki	81.63±1.62^{ab}	5.64±0.17^{abc}	35.73±1.39^{ab}	16.31±0.55^{bc}
	Peshawari	80.31±2.02^{abc}	5.75±0.09^{ab}	37.02±0.58^{a}	17.32±0.51^{ab}
Source of Variation			**P-Value**		
LR		<.0001	<.0001	<.0001	<.0001
AV		0.3221	0.0769	0.7473	0.0031
LR × AV		0.0012	<.0001	<.0001	<.0001

Values have been mentioned as Mean±SEM and various superscripted alphabets show significant ($P \leq 0.05$) differences among them (order of significance is as: a>b>c…….).

Discussion

The findings of present study revealed a considerable influence of dietary lysine regimens amongst Aseel birds as a significantly higher pre-slaughter/live body weight and post-slaughter weight was observed in L3 lysine regimen. The results of this study are in close lines with the findings of Pirzado *et al.* (2016) where, broilers showed a higher live body weight when fed with lysine level of 12g/kg in their feed. The same trend of increased live body weight was also observed in another study, where, broilers gained a maximum increase in live body weight when fed with ration supplemented with lysine (Eits *et al.*, 2003). Abbas (2014) also found maximum increase in live body weight and post-slaughter weight among Japanese quails when they were fed with 3-phase feeding lysine regimen, wherein protein/lysine as a growth enhancer was provided as per time of growth requirements. In the present study, significantly higher carcass weight and carcass yield has been shown by L3 lysine regimen. While, Mushki and Lakha showed an increased carcass weight and carcass yield, respectively, than the other varieties (Table 2, 3, 4). These findings are also in accordance with the results of Pirzado *et al.* (2016), where, highest carcass weight (1457.1±15.72g/bird) was depicted by broiler's group offered with feed containing 12g/kg lysine level than those provided with 13, 14 and 10g/kg lysine levels. The increase in carcass weight was also observed in another study where broiler chicken were fed with ration having 0.62 or 0.67 % lysine (Li *et al.*, 2013). A significantly higher live body weight and carcass weight was also reported amongst Aseel and other indigenous breeds without any treatment effect (Singh and Pathak, 2017). The present study also revealed significantly highest (P≤0.05) neck, breast and thigh percentages relative to carcass weight in L3 lysine regimen (Table 4). Rezaei *et al.* (2004) too found a significant (P<0.05) increase in carcass weight and breast meat yield % when feed containing 1.5g L-Lys.HCl/kg was offered to Ross broiler chicken

in starter and grower periods. Melaku *et al*. (2015) found a significant (P<0.05) increase in breast meat yield and drumstick weight, when rations deficient in lysine were supplemented with high synthetic lysine content (150%) and then were offered to broiler chicks. The present results are also in close lines with the findings of Hussain (2018) where, he reported a significant increase in carcass weight (p=0.0001) and carcass meat yields (p<.0001) among Aseel varieties fed with medium lysine levels. The authors further pointed out that regimen with medium lysine supplementation had a significant impact on slaughter weight, breast and thigh weights (p<.0001) as well as their yields in Mianwali variety of Aseel. However, Olivera *et al*. (2000) reported a significant impact of four-phased feeding on breast meat yield than three-phased feeding regimen. Significantly (P≤0.05) increased breast and thigh yields in the present study are endorsed to the fact of lysine availability rightly as per growth requirements of birds in L3 lysine regimen. Significantly improved giblets weight was observed in present study i.e., liver (41.92±1.17g), gizzard (44.58±0.90g) and heart (14.04±0.28g) relative to live weight in L3 followed by L2 and L1 lysine regimen. As nutrient requirement of Aseel vary in different phases of growth, improvement in giblets weight in our study might be attributed to the fact that the Aseel birds got maximum nutrients and lysine needed at various stages of their growth. Similarly, in another study, increase in liver, heart and gizzard weight was also reported, where high lysine content in feed influenced a more efficient conversion of amino acid resulting in increased giblets weight (Nasr and Kheiri, 2011). As far as, the visceral organs are concerned, the present study revealed an increased intestinal length and significantly (P≤0.05) improved intestinal weight in L3 lysine regimen. Abbas (2014) also found a significantly greater mean intestinal length (cm) and weight (g) among both male and female as well as in close-bred stocks of Japanese quails in 3-phased lysine regimen. Ullah *et al*. (2012) as well as Sklan and Noy (2000) reported in two separate studies the positive effect 1.4% lysine supplementation in starter diets to increase the intestinal length and digestive tract weight by increasing its digestion, absorption and enzymatic activity of pancreas, respectively. The inconsistent increase in intestinal length and weight was reported in a study, where, different dietary protein contents (20 to 40% with balanced or unbalanced amino acid supplementation) were offered to broiler chicks at the age of 10-24th day (Swatson *et al*., 2002). The findings of present study revealed that L3 lysine regimen had a positive impact on observed slaughter and carcass parameters, the reason for this was probably the in time availability of lysine as per growth requirements of birds for protein as was proved by Batool *et al*. (2018). Although, growth stage, sex, strain and genetics might also had a prominent effect on these parameters (Dozier *et al*., 2008). Aseel varieties showed non-significant variations for most of the observed slaughter and carcass characteristics which might be considered due to the genetic effect of slow growing birds.

Conclusions

This study indicated that when regimens containing various levels of lysine % were offered to Aseel birds in the form of phase-feeding, a significantly improved slaughter characteristics and carcass traits including breast and thigh % could be obtained. Furthermore, 3-phase feeding lysine regimen (L3) was found to be the best for providing the nutrients rightly as per growth requirements thus depositing the lysine and protein in body muscles to increase the lean meat in native Aseel chicken varieties.

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