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SUBSEQUENT EFFECTS OF VARIOUS DIETARY LYSINE REGIMENS ON PRODUCTION PERFORMANCE, EGG PERSISTENCY AND ECONOMICS OF INDIGENOUS ASEEL VARIETIES

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ABSTRACT

A study was conducted to evaluate the effects of different dietary lysine regimens on the subsequent productive performance, egg persistency and economics of Lakha, Mianwali, Mushki and Peshawari varieties of indigenous Aseel chicken from 28-43 weeks of age. For this purpose, 96 pullets constituting 24 from each variety, were randomly selected and maintained under standard management conditions. These birds were reared under 3 different dietary lysine regimens containing lysine 1.3 % (L1) for six weeks, 1.4 and 1.2 % (L2) each for three weeks and 1.5, 1.3 and1.1% (L3) each for two weeks. These dietary lysine regimens were fed from 0-6th week. The feed intake was significantly ($P \leq 0.05$) higher in Mianwali variety than Lakha, Peshawari and Mushki varieties. The cumulative egg number per hen, cumulative egg mass (g), egg weight (g), Hen day production (%) and Hen house production (%) were significantly ($P \leq 0.05$) higher in birds reared under L3 than L2 and L1 lysine regimens. Mushki variety showed highest egg production and persistency (28th to 35th week) than Peshawari, Mianwali and Lakha varieties and the birds reared under L3 were found to be more economical than L2 and L1 lysine regimens.

Key words: Lysine regimens, Aseel varieties, production potential, persistency and economics

INTRODUCTION

Aseel chicken breed has a prominent status among all the chickens being reared in rural zones of sub-continent. It is of the biggest size in all Indian indigenous chickens having 28 inches length from back to toe, upright posture, prominent stature, strong musculature, great stamina, strength and resistivity to diseases, making this breed well-acclimatized to tropical and sub-tropical environmental conditions all over the sub-continent (Bhatti *et al*., 1991; Dohner, 2001; Khan, 2004). In spite of owing all these physical characteristics, poor egg production by Aseel has been reported by Dohner (2001) and Pan (2009). Its poor performance carryout certain constraints associated with the socio-economic instabilities (FAO, 2007). Aseel chicken breed irrespective of its poor production performance is still unmatchable with other strains kept for marketing purpose (Kitalyi, 1998; Tadelle *et al.,* 2003). The genetically improved strains have also been developed from Aseel (CARI-Nirbheek and CARI-Shayama) by Central Avian Research Institute, India (ICAR, 2004). CARI reported the production of 92 eggs/annum with 52g average egg weight by improved Aseel chicken, whereas, an annual production of 33 eggs has been taken from Bangladeshi Aseel chicken without any improvement (Huque *et al.,* 1999; Bhuyian *et al.,* 2005). Haunshi *et al*. (2013) has reported the peak daily hen day production of 67.57 % at 31st week in Aseel, while 75.56 % at 35th week of age in Kadaknath. According to Mohan *et al*. (2008) the total egg production of Aseel is 160 eggs during the production period of 23-78 weeks, whereas, approximately a production of 50-55 eggs has been reported by Bangladeshi Aseel chicken (Yoshimura *et al*., 1997). Many other authors have also reported the improved egg production from indigenous breeds by adopting proper diet and management strategies. One of the strategy used by Faruque and Salahuddin (2009) was of intensive rearing system where they described that egg production from indigenous hens can be achieved up to 100-110 eggs from start of lay to 10th month of production when kept under intensive rearing system. Similarly, Khan (1983) opted proper selection program and obtained 135 eggs from Desi hens per year. Likewise, Chowdhury *et al*. (2006) also reported the double increase in egg production from indigenous chicken breeds by improving the regimens and house management conditions. Correspondingly, egg production was also improved by altering energy source, ingredients of feed and supplementation of amino acid(s). In layer diet, the source of energy is mainly provided by corn, while main protein sources are soybean meal, canola meal, rape seed meal, guar meal and sunflower meal, however, these ingredients and their composition is constituting a great deal of variations and the changes in their composition can influence the performance of the birds (Aman and Graham, 1990). Addition of lysine and total sulfur amino acid in particular proportion in feed can change the egg production and composition (Novak *et al*., 2004). Khan *et al*. (2011) stated that supplementation of dietary probiotics can result in the production of low-cholesterol chicken eggs which are highly appreciated by fitness conscious people. Figueiredo *et al*. (2012) indicated a quadratic effect of increase in egg weight, egg mass and feed conversion when 0.754, 0.772 and 0.795% levels of digestible lysine have been used. Okitoi *et al*. (2009) supplemented scavenging chickens with protein and energy together from soybean meal and maize meal sources which resulted in more daily feed intake and therefore, resulted in higher gain, feed conversion ratio, mean egg weight, egg mass and percent egg production than those scavenging chickens who were offered feed along with single and separate source of energy and protein.

Keeping in view the positive effects of different feeding strategies to improve egg production parameters, the present study was planned to evaluate the comparative production performance and persistency of egg production in varieties of Indigenous Aseel chicken reared under different dietary lysine regimens.

MATERIALS AND METHODS

The present study revealed the assessment of subsequent effects of various lysine regimens on productive performance, persistency of egg production and economics in Lakha, Mianwali, Mushki and Peshawari varieties of Aseel. These birds have been reared under different dietary lysine regimens containing 1.3 % lysine (L1) for six weeks, 1.4% and 1.2 % (L2) each for three weeks and 1.5, 1.3, and 1.1% lysine (L3), each for two weeks (Table 1). The subsequent effects of this rearing period on production performance parameters were evaluated from 28th to 43rd week. For this purpose, 96 pullets constituting 24 from each of the four varieties *i.e.,* Lakha, Mianwali, Mushki and Peshawari were randomly selected and placed in three-tiered identical cage units or blocks each with a space of 1.5 square feet. The cages were well equipped with feeders, removable dropping trays and slanted wire floors for easy collection of droppings and eggs. These laying cages were placed in well-aerated enclosure with plastered walls, concrete floor and slab ceiling. The enclosures were facilitated with rotating mist fans, air coolers and heaters for the maintenance of room temperature during dry hot summer and cold winter season.

Data Collection: Data regarding feed intake was taken on daily basis while egg collection was done twice a day *i.e.,* in the morning and evening. A daily allowance of measured feed (95g per hen) formulated according to NRC standards was offered to experimental birds early in the morning and feeders were used to remove after two hours of feeding to weigh the residue for feed intake. The eggs produced by each hen were collected, tagged and then weighed by using electronic balance having the capacity to measure up to 0.1g. Cumulative egg mass per hen was calculated by dividing total egg mass with total egg number from each hen. The FCR per dozen of eggs and FCR per kg egg mass, hen housed and hen day egg production percentages were calculated by using the following formulae.

$$\text{FCR/Dozen eggs} = \frac{\text{Total Feed Consumed (Kg)}}{\text{Number of Eggs Produced}} \times 12$$

$$\text{FCR/Kg Egg Mass} = \frac{\text{Total Feed Consumed (Kg)}}{\text{Total Egg Mass Produced (Kg)}}$$

$$\text{Hen Day Egg Produciton \%} = \frac{\text{Number of Eggs Produced}}{\text{Number of females present at that day}} \times 100$$

Day1*= day after 3 days of adaptation period just at the start of trial

The data after analysis of homogeneity and uniformity, were exposed to two-way ANOVA (Analysis of Variance) as a randomized complete design having dietary lysine regimens, Aseel varieties and interactions among them as core effects. Treatment means were compared through Duncan's Multiple Range Test

$$\text{Hen Housed Egg Produciton \%} = \frac{\text{Number of Eggs Produced}}{\text{Number of females present at day1*}} \times 100$$

(Duncan, 1955). All the tabulated data have been mentioned as means and their standard errors and the results were considered significant at P≤0.05.

RESULTS AND DISCUSSION

Body weight: Significant (P≤0.05) differences in body weight were noted in lysine regimens and varieties. L3 (1.5%-1.3%-1.1%) showed higher body weight (1884g) than L2 (1.4%-1.2 %) and L1 (1.3 %) lysine regimens (1832 and 1823g, respectively). Among Aseel varieties, Peshawari variety showed significantly (P≤0.05) higher body weight than Mianwali, Mushki and Lakha varieties and similar lead in higher body weight was also shown by Peshawari variety when the interactions between lysine regimens and Aseel varieties were considered (Table 2). This increase in body weight might be due to significant impact of genetic group as was reported by Chatterjee *et al.* (2007), Devi and Reddy (2005) and Mohammed *et al.* (2005). The increased body weight of birds, in the present study within L3 lysine regimen may be attributed to the timely fulfilment of bird's nutritive requirements during rearing period and can be correlated with the findings of other studies, wherein, timely accomplishment of nutritive demands resulted in boosted immuno-competence (Taghinejad-Roudbaneh *et al*., 2011) which intern sustained the high body weight of the birds by keeping them secure from disease attacks (Humphrey *et al*., 2002). The results of present study are also in close lines with the findings of Abbas *et al*. (2016)

on Japanese quails, who also attributed the increased body weight due to timely fulfilment of nutritive needs according to the bird's age. Poosuwan *et al.* (2009) revealed that the satisfactory dietary conditions of amino acids are essential for nourishing normal immuno-competence and attaining maximum production performance.

Feed intake: Non-significant differences (P>0.05) in cumulative feed, CP, calories, calcium, phosphorous, lysine and methionine intake (g) were noted in different dietary lysine regimens (Table 2) Among the varieties, Mianwali showed significantly (P≤0.05) higher feed and CP intake than other three varieties. However, Lakha, Mianwali and Peshawari varieties utilized more calories, calcium, phosphorous, lysine and methionine than Mushki variety (Table 2). As far as, the interactions between lysine regimens and Aseel varieties are considered, the higher feed and CP, calories, calcium, phosphorous, lysine and methionine intake was observed in Mianwali variety with L2 lysine regimen than Peshawari, Lakha and Mushki varieties (Table 2). Figueiredo *et al.* (2012) in their studies on Lohmann LSL layers and on Hy-Line W36 laying hens, respectively, reported non-significant (P>0.05) effect of dietary threonine while lysine levels displayed substantial effects on feed intake. They mentioned that amino acid imbalance may lead to functional and metabolic changes which resulted the alterations in eating behavior. Similarly, Cupertino *et al*. (2009) and Rocha *et al.* (2009) demonstrated linear relationship between dietary lysine levels and feed intake. Iqbal *et al.* (2012) also reported the similar feed intake variations in four varieties of Aseel chicken without any treatment effect which may be attributed to the genetic impact of varieties.

Egg Production and persistency of egg production: Significant (P≤0.05) differences were observed in cumulative egg number per hen and cumulative egg mass (g) both within lysine regimens and Aseel varieties (Table 3). The birds reared on L3 lysine regimen showed higher cumulative egg production and egg mass than those reared on L2 and L1 lysine regimens. Among Aseel varieties, both Mushki and Peshawari varieties showed better egg production and egg mass than Mianwali and Lakha varieties (Table 3). As far as, interactions among lysine regimens and Aseel varieties are considered, Mushki and Peshawari varieties revealed better egg production and egg mass in L3 lysine regimen than Mianwali and Lakha varieties (Table 3). The higher egg production and egg mass in L3 lysine regimen in this case can be attributed to the fulfilment of bird's nutritional requirement according to the age demand (Scheideler *et al*., 1996). The improved egg production in the present study might also be attributed to the deposition of lysine in the body which decreased fat pad's existence around in reproductive organs as was reported by Oliveira *et al.* (2013). A linear relationship between lysine supply and protein deposition within body muscles was also reported in their study which led into increased weight and improved feed conversion ratio that finally improved the egg production. Usman *et al*. (2014) reported a decrease in egg production due to increase in fat pads on reproductive organs followed by increasing age. Oliveira *et al*. (2013) also demonstrated that the provision of particular levels of digestible lysine *i.e.,* 13.0 and 14.0 g/kg in the bird's diet from the age of 8 to 21 day can provide best production performance during later age. Similarly, Fakhraei *et al*. (2010) reported that supplemental lysine (in variable amount depending upon physiological parameters of bird's production prestige) is beneficial in corn and soybean meal diets of broiler breeder for better egg production. Different levels of supplemental lysine *i.e.,* 0.64, 0.67 and 0.63 % have a significant impact on egg production (%), egg mass (g) per hen per day, egg contents (g) and settable eggs (%), respectively. Contrarily, Jackson *et al*. (1989) reported non-significant effects of adding 0.1 % L-Lysine HCl on the production of eggs or feed efficiency, whilst, the weight of egg decreased by 0.8 g specifying the more amino acid obligation for higher weight of egg than its production. Moreover, 18 % CP constituting diet have the significant effect in increasing the production performance and addition of synthetic L-Lysine and DL-methionine along with the limited protein consumption can have better impact on production performance and protein utilization of laying hens (Bunchasak and Silapasorn, 2005; Narvaez-Solarte *et al*., 2005). According to Poosuwan *et al.* (2009) the birds fed diets containing 18 % CP showed better egg production, egg weight, egg mass, protein intake, feed and energy efficiency than those containing 14 % CP. Liu *et al.* (2005) and Wu *et al.* (2007), demonstrated that egg production (EP), egg weight (EW), egg mass (EM), feed consumption, feed conversion and body weight (BW) of hens became significantly improved by increasing the lysine level.

Significant (P≤0.05) differences in egg weights were shown among different lysine regimens and varieties (Table 3). Egg weights of Peshawari and Mianwali varieties were significantly (P≤0.05) higher than those of Lakha and Mushki varieties (Table 3). Among the interactions between Lysine levels and Aseel varieties, Mianwali variety showed the better egg weight with L2 lysine regimen than Peshawari, Lakha and Mushki varieties and L3 and L1 lysine regimens. Furthermore, significant (P≤0.05) differences in FCR/kg egg mass, feed/dozen eggs (kg), hen day and hen housed production (%) were observed not only within lysine regimens but also within Aseel varieties (Table 4). During this production performance, the birds reared on L3 lysine regimen showed better FCR/kg egg mass, less utilization of feed (kg) for producing a dozen of eggs

(FCR/dozen eggs), hen day and hen housed production (%), (Table 4). As far as, the Aseel varieties are considered, both Mushki and Peshawari varieties showed significantly (P≤0.05) highest hen day and hen housed production (%) followed by Mianwali and then Lakha variety (Table 4). Among the interactions between lysine regimens and Aseel varieties, Mushki and Peshawari both varieties showed a higher hen day and hen housed production (%) in L3 lysine regimen. In the present study, sexual maturity of Aseel birds was attained at 26th week which was late than that reported by Mohan *et al.* (2008) and Haunshi *et al.* (2011) that was probably due to the increased day light in the later period of bird's growing age and partly due to the better management practices as was reported by this author. The earlier maturity attainment, in the present case, may be due to the treatment effect and fulfilment of bird's lysine requirements as per age demand which resulted in increased deposition of lysine in body and hence the increased body weight lead to early maturity and better production performance (Novak *et al*., 2004). In the present study, Aseel birds showed maximum egg production and persistency of egg production (Table 5 & 6) between 28th and 35th week of age. Although, the outcomes of study conducted by Haunshi *et al.* (2013) showed the maximum production persistency between 24th to 36th week of age in Aseel. They further reported the peak daily hen day production % (HDEP) of 67.57 % in Aseel on an average day during 31st week of production, which was higher than the present value of HDEP % (Table 5 & 6).

Economic Analysis: The breakup of various components affecting the economics of Aseel birds during production period from 28th to 43rd week has been given in Table 7. The overall expenses (excluding the pullets purchase price as the present birds were self-reared in extension of the growth study from day old chick) were higher in birds reared in 1.3 % (L1) followed by 1.4%- 1.2 % (L2) and then the 1.5-1.4-1.1% (L3) lysine regimen. As the total expenditures spent on each pullet exceeded the sale price of eggs so the net loss and loss (%) has been highest in L1 followed by L2 and then L3 lysine regimen (Table 7). The results of economic analysis indicated that 3-phase feeding lysine regimen is better for boosting the initial growth of the bird during rearing phase as was reported in Japanese quails by Abbas *et al*. (2016). They have mentioned that 3-phase feeding regimen is quite better for enhancing the growth and resulted in more profit and income. The present findings indicated that improved growth maintained during later period lead to early maturity and increased production of eggs by L3 lysine regimen. This resulted in low cost of production in L3 lysine regimen. Bouyeh and Gevorgian (2011) reported that production cost could be reduced by substitute reduction of dietary protein and addition of lysine and total sulfur amino acids (TSAA) in the diet of post peak laying hens. Lomeli *et al.* (2009) also observed that expenditures on the rearing of Japanese quails could be reduced when CP was reduced from 24% to 21% during the first two weeks of growth.

Table 1. 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 µg; nicotinic acid 20 mg; folic acid 1 mg; pantothenic acid 10 mg; biotin 50 µg; choline chloride 500 mg; copper 10 iron 30 mg; manganese 55 mg; zinc 50 mg; iodine 1 mg; selenium 0.1 mg.

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

Table 2. Body weight, feed intake and nutrient intake (g) in four varieties of Aseel chicken reared under different dietary lysine regimens from 28-43 weeks of age

Treatments	Parameters	Body Weight	Total Feed Intake	Crude Protein	ME(Calories)	Calcium	Phosphorous	Lysine	Methionine
Lysine (%)/Regimens									
1.3 (L1)		1823±11.1^{b}	8565±27.1	1370±4.3	24348±56.4	256±0.6	34±0.1	68±0.2	39±0.1
1.4-1.2 (L2)		1832±9.8^{b}	8560±9.8	1370±3.1	24396±54.8	257±0.6	34±0.1	69±0.2	40±0.1
1.5-1.3-1.1 (L3)		1884±11.8^{a}	8553±12.7	1369±2.0	24376±36.2	257±0.4	34±0.1	68±0.1	39±0.1
Varieties									
Lakha		1820±12.8^{c}	8553±21.26^{ab}	1368±3.4^{ab}	24375±60.6^{a}	257±0.6^{a}	34±0.1^{a}	68±0.2^{a}	40±0.1^{a}
Mianwali		1861±14.1^{ab}	8603±18.7^{a}	1376±3.1^{a}	24517±533^{a}	258±0.6^{a}	34±0.1^{a}	69±0.2^{a}	40±0.1^{a}
Mushki		1829±9.9^{bc}	8525±31.9^{b}	1364±5.1^{b}	24213±49.8.1^{b}	255±0.5^{b}	34±0.1^{b}	68±0.1^{b}	39±0.1^{b}
Peshawari		1875±14.3^{a}	8557±17.6^{ab}	1369±2.8^{ab}	24388±50^{a}	257±0.5^{a}	34±0.1^{a}	69±0.1^{a}	40±0.1^{a}
Lysine Levels (%)/Regimens × Varieties									
1.3 (L1)	Lakha	1815±15.1^{cde}	8552±55.9^{ab}	1368±9.1^{ab}	24374±159.4^{bc}	257±1.7^{bc}	34±0.2^{bc}	68±0.5^{bc}	40±0.3^{abc}
	Mianwali	1814±27.4^{cde}	8576±23.3^{ab}	1372±3.7^{ab}	24441±66.4^{b}	257±0.7^{b}	34±0.1^{b}	69±0.2^{b}	40±0.1^{ab}
	Mushki	1805±16.7^{de}	8552±88.5^{ab}	1368±14.2^{ab}	24124±77.6^{c}	254±0.8^{c}	34±0.1^{c}	68±0.2^{c}	39±0.1^{d}
	Peshawari	1857±22.3^{bcd}	8579±35.9^{ab}	1373±5.7^{ab}	24451±102.3^{b}	257±1.1^{b}	34±0.1^{b}	69±0.3^{b}	40±0.1^{ab}
1.4-1.2 (L2)	Lakha	1787±16.0^{e}	8544±20.0^{ab}	1367±3.2^{ab}	24351±57.0^{bc}	256±0.6^{bc}	34±0.1^{bc}	68±0.2^{bc}	39±0.1^{bcd}
	Mianwali	1872±18.7^{abc}	8671±4.8^{a}	1388±4.5^{a}	24713±79.6^{a}	260±0.8^{a}	35±0.1^{a}	69±0.2^{a}	40±0.1^{a}
	Mushki	1823±14.2^{cde}	8461±32.6^{b}	1354±5.2^{b}	24116±93.1^{c}	254±1.0^{c}	34±0.1^{c}	68±0.3^{c}	39±0.2^{cd}
	Peshawari	1844±18.8^{cde}	8562±33.6^{ab}	1370±5.4^{ab}	24402±956^{bc}	257±1.0^{bc}	34±0.1^{bc}	69±0.3^{bc}	40±0.1^{ab}
1.5-1.3-1.1 (L3)	Lakha	1857±27.9^{bcd}	8561±30.1^{ab}	1370±4.8^{ab}	24398±85.9^{bc}	257±1.0^{bc}	34±0.1^{bc}	69±0.2^{bc}	40±0.2^{abc}
	Mianwali	1897±18.4^{ab}	8560±33.1^{ab}	1370±5.3^{ab}	24397±94.3^{bc}	257±1.1^{bc}	34±0.1^{bc}	69±0.3^{bc}	40±0.1^{abc}
	Mushki	1858±16.7^{bcd}	8560±17.6^{ab}	1370±2.8^{ab}	24397±50.1^{bc}	257±0.5^{bc}	34±0.1^{bc}	69±0.1^{bc}	39±0.1^{bcd}
	Peshawari	1925±25.0^{a}	8530±21.3^{b}	1365±3.4^{b}	24312±60.7^{b}	256±0.6^{bc}	34±0.1^{bc}	68±0.2^{bc}	39±0.1^{bcd}

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…….)
ME=Metabolizable energy

Table 3. Production performance (from 28 to 43 weeks) in four varieties of indigenous Aseel chicken reared under different dietary lysine regimens

Parameters / Treatments		Egg Weight (g)	Cumulative Egg No. /Hen	Cumulative Egg Mass (g)
Lysine Levels (%)/Regimens				
1.3 (L1)		47.17±0.21^{b}	30.81±1.14^{b}	1415.19±49.69^{b}
1.4-1.2 (L2)		47.50±0.23^{a}	30.88±0.95^{b}	1421.56±39.67^{b}
1.5-1.3-1.1 (L3)		47.63±0.19^{a}	33.75±1.14^{a}	1551.44±49.37^{a}
		Varieties		
Lakha		47.65±0.11^{b}	24.96±0.72^{c}	1149.50±30.36^{c}
Mianwali		48.29±0.13^{a}	30.13±0.82^{b}	1419.00±33.82^{b}
Mushki		45.58±0.11^{c}	36.79±0.99^{a}	1641.42±43.18^{a}
Peshawari		48.22±0.07^{a}	35.38±0.79^{a}	1641.00±35.78^{a}
Lysine Levels (%)/Regimens × Varieties				
1.3 (L1)	Lakha	47.57±0.14^{d}	23.25±1.01^{g}	1073.38±44.78^{f}
	Mianwali	47.65±0.22^{d}	28.50±1.61^{def}	1335.88±67.01^{de}
	Mushki	45.31±0.18^{f}	35.75±1.66^{abc}	1590.88±71.93^{abc}
	Peshawari	48.16±0.17^{bc}	35.75±0.82^{abc}	1660.63±38.14^{ab}
1.4-1.2 (L2)	Lakha	47.56±0.28^{d}	24.75±1.08^{fg}	1135.75±39.01^{f}
	Mianwali	48.72±0.09^{a}	29.88±1.59^{de}	1417.88±62.95^{cd}
	Mushki	45.51±0.16^{ef}	36.38±1.27^{ab}	1624.63±54.65^{ab}
	Peshawari	48.21±0.08^{bc}	32.50±0.76^{bcd}	1508.00±27.76^{bcd}
1.5-1.3-1.1	Lakha	47.82±0.12^{cd}	26.88±1.42^{efg}	1239.38±59.55^{f}
(L3)	Mianwali	48.49±0.14^{ab}	32.00±0.78^{cd}	1503.25±28.64^{bcd}
	Mushki	45.92±0.18^{e}	38.25±2.21^{a}	1708.75±95.75^{a}
	Peshawari	48.30±0.12^{abc}	37.88±1.67^{a}	1754.38±77.31^{a}

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>d…)

Table 4. Production performance (from 28 to 43 weeks) in four varieties of indigenous Aseel chicken reared under different dietary lysine regimens

Parameters / Treatments		FCR/Kg Egg Mass	Feed/Dozen Eggs (kg)	Hen Day Production%	Hen House Production%
Lysine Levels (%)/Regimens					
1.3 (L1)		6.31±0.24^{a}	3.49±0.14^{a}	33.13±1.22^{b}	32.10±1.19^{b}
1.4-1.2 (L2)		6.18±0.19^{a}	3.44±0.12^{b}	33.20±1.02^{b}	32.16±0.99^{b}
1.5-1.3-1.1(L3)		5.69±0.19^{b}	3.15±0.11^{c}	36.29±1.22^{a}	35.16±1.18^{a}
Varieties					
Lakha		7.56±0.19^{a}	4.19±0.12^{a}	26.84±0.78^{c}	26.00±0.75^{c}
Mianwali		6.14±0.15^{b}	3.49±0.10^{b}	32.39±0.88^{b}	31.38±0.85^{b}
Mushki		5.27±0.14^{c}	2.83±0.07^{c}	39.56±1.07^{a}	38.32±1.03^{a}
Peshawari		5.27±0.11^{c}	2.93±0.06^{c}	38.04±0.85^{a}	36.85±0.82^{a}
Lysine Levels (%)/Regimens × Varieties					
1.3	Lakha	8.07±0.35^{a}	4.47±0.20^{a}	25.00±1.09^{g}	24.22±1.06^{g}
(L1)	Mianwali	6.52±0.29^{cd}	3.68±0.19^{c}	30.65±1.74^{def}	29.69±1.68^{def}
	Mushki	5.45±0.24^{f}	2.91±0.13^{ef}	38.44±1.78^{abc}	37.24±1.72^{ac}
	Peshawari	5.19±0.12^{f}	2.89±0.07^{ef}	38.44±0.88^{abc}	37.24±0.85^{abc}
1.4-1.2	Lakha	7.59±0.26^{ab}	4.20±0.19^{ab}	26.61±1.16^{fg}	25.78±1.13^{fg}
(L2)	Mianwali	6.20±0.28^{de}	3.55±0.19^{cd}	32.12±1.65^{de}	31.12±1.65^{de}
	Mushki	5.25±0.17^{f}	2.82±0.10^{ef}	39.11±1.36^{ab}	37.89±1.32^{ab}
	Peshawari	5.69±0.10^{ef}	3.17±0.07^{def}	34.95±0.81^{bcd}	33.85±0.79^{bcd}
1.5-1.3-1.1	Lakha	7.01±0.31^{bc}	3.89±0.19^{bc}	28.90±1.53^{g}	27.99±1.48^{efg}
(L3)	Mianwali	5.71±0.12^{ef}	3.22±0.08^{de}	34.41±0.84^{cd}	33.33±0.81^{cd}
	Mushki	5.12±0.29^{f}	2.75±0.16^{ef}	41.13±2.38^{a}	39.84±2.30^{a}
	Peshawari	4.93±0.22^{f}	2.74±0.12^{f}	40.73±1.80^{a}	39.45±1.74^{a}

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>d…)

Table 5. Egg production and Persistency of production in four varieties of Aseel (28-43weeks)

Aseel Varieties	28-31(weeks)			28-35(weeks)			28-39(weeks)			28-43(weeks)		
	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)
Lakha	3.29	13.690	13.690	7.07	18.018	18.018	6.39	19.361	19.236	4.64	23.289	21.586
Mianwali	3.32	13.839	13.839	7.50	19.279	18.946	10.29	25.515	25.107	4.71	26.122	26.018
Mushki	4.93	20.536	20.536	14.04	34.792	34.170	9.11	31.974	31.613	3.46	31.757	31.680
Peshawari	4.50	18.750	18.750	12.61	31.324	30.765	7.89	28.382	28.069	5.32	30.661	30.543

HDEP*= Hen day egg production; HHEP**= hen house egg production

Table 6. Egg production and Persistency of production in four varieties of Aseel (28-43weeks)

Aseel Varieties	28-31(weeks)			32-35(weeks)			36-39(weeks)			40-43(weeks)		
	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)	Egg No.	HDEP* (%)	HHEP** (%)
Lakha	3.29	13.690	13.690	7.07	29.464	29.464	6.39	27.795	26.637	4.64	20.186	19.345
Mianwali	3.32	13.839	13.839	7.50	32.609	31.250	10.29	46.753	42.857	4.71	21.429	19.643
Mushki	4.93	20.536	20.536	14.04	61.025	58.482	9.11	41.396	37.946	3.46	15.747	14.435
Peshawari	4.50	18.750	18.750	12.61	54.814	52.530	7.89	34.317	32.887	5.32	23.137	22.173

HDEP*= Hen day egg production; HHEP**= hen house egg production

Table 7. Economic appraisal of Aseel birds (for 16 weeks) reared under different dietary lysine regimens

Cost items	Lysine Phases/ Regimens		
	L1 (1.3%)	L2 (1.4-1.2%)	L3 (1.5-1.4-1.1%)
Housing (equipped) @ Rs. /pullet	85	85	85
Labor charges @ Rs. /pullet	70	70	70
Feed consumed (kg)/pullet	9.14	8.84	8.55
Feeding expenses @ Rs.45/kg feed/pullet	414.30	397.80	384.75
Vaccination & Medication/pullet	65	65	65
Overall mortality (%)	6.25	3.13	0.00
Overhead loss due to mortality/pullet (Rs)	66.67	32.26	0.00
Miscellaneous expenses/pullet	25	25	25
Sale of eatable eggs/pullet	30.81	30.88	33.75
Cost of eggs @ Rs.12 /egg	369.72	370.56	405.00
Overall expenses Rs. /pullet	725.97	675.06	629.75
Net profit/loss (Rs)/pullet	-356.25	-304.50	-224.75
Profit/Loss (%)/pullet	-49.07	-45.11	-35.69

Conclusion: Provision of sufficient quantity and levels of dietary essential amino acids, predominantly lysine is obligatory in accordance with the growth requirement (phase-vise supply) for achieving the maximum production performance, persistency of production and hence the economic efficiency in indigenous Aseel varieties. Lysine supplemented as in L3 regimen was found to be better and should be recommended for obtaining the better production performance.

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