Sjournals
Scientific Journals
Scientific Journal of Zoology (2013) 2(5) 46-53
ISSN 2322-293X

Contents lists available at Sjournals
SCIENTIFIC JOURNAL OF ZOOLOGY
Journal homepage: www.Sjournals.com

Original article

Body measurements and slaughter parameters in four close bred stocks of Japanese quail reared under different levels of dietary lysine

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A R T I C L E I N F O

Article history:
Received 03 May 2013
Accepted 18 May 2013
Available online 29 May 2013

Keywords:
Japanese quail
Close bred stocks
Dietary lysine
Body measurements
Slaughter parameters

A B S T R A C T

The aim of study was to evaluate body measurements and slaughter parameters in four close bred stock (CBS) of Japanese quail (named as Major (M), Kaleem (K), Saadat (S) and Zahid (Z)) reared under different levels of dietary lysine at Avian Research and Training (ART) Centre, UVAS Lahore, Pakistan. For this purpose 1440 broiler quail chick were procured form ART Centre hatchery, birds were reared at different levels of dietary lysine i.e. 1.3% lysine for 28 days (Phase-I), 1.4% lysine for 1st 14 days and 1.2% lysine for last 14 o (Phase-II), 1.5% lysine for 9 days, 1.3% lysine for next 10 days and 1.1% lysine for last 9 days (Phase-III). A total of 108 birds {4(CBS)×3(Phases)×9 birds}, were slaughtered at the age of 27 weeks and their body measurements and slaughter parameters were recorded. The data thus obtained were statistically analyzed through Randomized Complete Block Design (RCBD). The means were separated out through Duncan's Multiple Range test using SAS 9.1 for windows. Statistical analysis revealed significant differences ($P < 0.05$) among different CBS and Phases. In body measurements body, shank and drumstick length and drumstick circumference showed significant difference ($P<0.05$) while wing spread, keel length and shank circumferences showed non-significant difference. In slaughter parameters carcass, heart and gizzard weight, and intestinal length showed significant differences ($P<0.05$) whereas body, liver and intestinal weight showed non-significant differences.

1. Introduction

The Japanese quail (*Coturnix coturnix japonica*), because of its short generation interval (3-4 generations per year), early sexual maturity and easy maintenance make it an interesting laboratory animal in the field of search. In the selection of meat type quail line quality of eggs play an important role for the propagation of flocks. Since the early 1970s a lot of research work carried out aiming to reduce cost of production, on the other hand growth and structure of muscle also modified by selection (Santoso, 2002; Rémignon and Bihan-Duval, 2003). Now it is therefore required to improve nutritional requirement of Japanese quail as amino acid recommended by NRC 1994 are mainly based on research conducted before 1994 (Kaur et al., 2008). Lysine being second limiting amino acid mostly used in corn based diet when ideal balance is required because it represents major effect on carcass composition (Corzo et al., 2002). Deficiency of dietary amino acids may effect performance of chicken (Kaur et al., 2008) but the effect of lysine on body measurement and carcass parameters in Japanese quail is still debatable. So present study was conducted to evaluate effect of different dietary lysine levels on body measurement and slaughter parameters in four close bred stock of Japanese quails.

2. Materials and methods

Present study was conducted at Avian Research and Training Centre, University of Veterinary and Animals Sciences, Lahore, Pakistan to evaluate body measurements and slaughter parameters in four close bred stock (CBS) of Japanese quail named as Major (M), Kaleem (K), Saadat (S) and Zahid (Z). For this purpose 1440 broiler quail chick were procured form ART Centre hatchery, birds were reared at different levels of dietary lysine i.e. 1.3% lysine for 28 days (Phase-I), 1.4% lysine for 1st 14 days and 1.2% lysine for last 14 o (Phase-II), 1.5% lysine for 9 days, 1.3% lysine for next 10 days and 1.1% lysine for last 9 days (Phase-III). After the age of 27 weeks, 108 birds {4(CBS)×3(Phases)×9 birds} were slaughtered and their body measurement and slaughter parameters were recorded.

2.1. Parameter studied

Body measurements: bird length (cm), wing spread (cm), keel length (cm), shank length (cm), shank circumference (cm), drumstick length (cm), drumstick circumference (cm)

Slaughter parameters: body weight (g), carcass weight (g), liver weight(g), gizzard weight (g), heart weight (g), intestinal length (cm), intestinal weight (g)

2.2. Statistical analysis

Data thus obtained were statistically analyzed through ANOVA techniques (Snedecor and Cochran, 1994) according to Randomized Complete Block Design (RCBD) in factorial arrangement, means were separated out through Duncan's Multiple Range (Duncan, 1955) test by using SAS 9.1 for windows.

3. Results and discussion

3.1. Body measurements

3.1.1. Body length (cm)

Means within columns with different superscripts are significantly (P<0.05) different from other

Present study revealed significant differences (P<0.05) in body length among different close bred stocks and phases of dietary lysine. Birds of CBS Z showed the maximum value (32.22cm) for bird's length whereas minimum value (31.37) was also observed in CBS K. However, non-significant differences were observed in different phases. Similar findings was also observed by (Ahmad et al., 2013) who found significant effect of dietary lysine on body length of Japanese quail.

Table 1
Effect of dietary lysine levels on bird's length (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	31.67±0.55^{ab}	31.89±0.54^{ab}	31.94±0.44^{ab}	32.11±0.20^{ab}	31.90±0.22
Phase-II	32.33±0.58^{ab}	31.11±0.48^{b}	31.72±0.55^{ab}	33.00±0.24^{a}	32.04±0.26
Phase-III	32.11±0.56^{ab}	31.11±0.35^{b}	31.44±0.41^{b}	31.56±0.18^{ab}	31.56±0.20
Means	32.04±0.32^{AB}	31.37±0.27^{B}	31.70±0.26^{AB}	32.22±0.16^{A}	

3.1.2. Wing Spread (cm)

Non-significant differences were observed in bird’s wing spread among four close bred stocks and three phases of dietary lysine. Among CBS S showed maximum value for wing spread while minimum value was observed in CBS K. Similarly no significant effect of dietary lysine on wing spread of japanese quail was also reported by (Ahmad et al., 2013).

Table 2
Effect of dietary lysine levels on bird's wing spread (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	15.33±0.37	15.61±0.48	16.33±0.28	15.67±0.29	15.74±0.19
Phase-II	16.11±0.26	15.89±0.45	16.66±0.41	16.56±0.41	16.31±0.19
Phase-III	15.33±0.60	16.28±0.30	16.67±0.47	15.67±0.33	16.24±0.22
Means	15.93±0.26	15.93±0.24	16.56±0.22	15.96±0.21	

3.1.3. **Keel length (cm)**

In the present study CBS showed significant effect of dietary lysine from which CBS M remained the highest in terms of keel length (cm). However, in different phases no significant effect was observed. In overall interaction there were non-significant differences among CBS and phases. These results are in line with (Ahmad et al., 2013) who also reported non-significant differences in keel length of Japanese quail when supplemented with different levels of dietary lysine.

Table 3
Effect of dietary lysine levels on bird's keel length (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	6.56±1.13	6.14±0.11	6.23±0.10	6.23±0.09	6.31±0.06
Phase-II	6.39±0.13	6.22±0.11	6.23±0.10	6.13±0.11	6.26±0.06
Phase-III	6.53±0.17	6.27±0.16	6.14±0.22	6.12±0.14	6.27±0.09
Means	6.49±0.08^{A}	6.21±0.07^{B}	6.23±0.09^{B}	6.18±0.07^{B}	

Means within columns with different superscripts are significantly ($P<0.05$) different from other.

3.1.4. **Shank length (cm)**

In the present study significant differences were observed in shank length among CBS and Phases. In CBS, M showed the maximum value for the shank length while Z showed the minimum value. In different phases of dietary lysine maximum value was observed in phase-I whereas the lowest value was observed in phase-III. Similarly, significant effect of dietary lysine on shank length of Japanese quail was also reported by (Ahmad et al., 2013).

Table 4
Effect of dietary lysine levels on bird's shank length in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	4.86±0.23^{a}	4.33±0.12^{bc}	3.88±0.17^{d}	3.98±0.05^{cd}	4.26±0.10^{A}
Phase-II	4.46±0.11^{b}	4.09±0.08^{bcd}	4.09±0.15^{bcd}	4.08±0.13^{bcd}	4.18±0.06^{AB}
Phase-III	4.16±0.10^{bcd}	4.00±0.11^{cd}	4.08±0.13^{cd}	4.01±0.07^{bcd}	4.06±0.05^{B}
Means	4.49±0.10^{A}	4.14±0.16^{B}	4.02±0.09^{B}	4.02±0.05^{B}	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.1.5. Shank circumference (cm)

In CBS, K showed the maximum value for shank circumference while lowest value was observed in CBS, M. In overall interaction there is no clear cut trend of shank circumference. These results are in accordance with (Ahmad et al., 2013) who also observed no significant effect of dietary lysine on shank circumference in Japanese quail.

Table 5
Effect of dietary lysine levels on bird's shank circumference (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	1.60±0.06	1.72±0.07	1.74±0.07	1.77±0.06	1.71±0.03
Phase-II	1.80±0.06	1.80±0.08	1.68±0.07	1.72±0.09	1.75±0.04
Phase-III	1.71±0.07	1.73±0.09	1.78±0.07	1.77±0.08	1.75±0.04
Means	1.70±0.04	1.75±0.05	1.73±0.04	1.75±0.04	

Non-significant differences in bird's shank length among different CBS and Phases were observed in present study.

3.1.6. Drumstick length (cm)

In the present study significant differences were observed among four close bred stocks in drumstick length from which CBS, M remained the highest in terms of drumstick length whereas CBS, Z showed the minimum value. However, in different phases non-significant differences were also observed. In overall interaction there was significant effect of dietary lysine on drumstick length. Similarly, significant effect of different regimes of dietary lysine on drumstick length of Japanese quails was also reported by (Ahmad et al., 2013).

Table 6
Effect of dietary lysine levels on bird's drumstick length (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	6.08±0.14^{a}	5.91±0.10^{ab}	5.79±0.12^{abc}	5.40±0.13^{bc}	5.79±0.07
Phase-II	5.79±0.19^{abc}	5.61±0.14^{abc}	5.54±0.19^{bc}	5.36±0.18^{c}	5.58±0.09
Phase-III	5.89±0.18^{ab}	5.74±0.10^{abc}	5.64±0.23^{abc}	5.31±0.15^{c}	5.64±0.09
Means	5.92±0.10^{A}	5.75±0.07^{A}	5.66±0.10^{A}	5.36±0.09^{B}	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.1.7. Drumstick circumference (cm)

In the present experiment significant difference were observed in drumstick circumference among four close bred stocks and three phases. In CBS, M showed the maximum value for drumstick circumference whereas CBS, S showed the lowest value. However, non-significant differences was observed among three phases. Similar finding were also reported by (Ahmad et al., 2013) who found significant differences in drumstick circumferences of Japanese quail when supplemented different levels of dietary lysine.

Table 7
Effect of dietary lysine levels on bird's drumstick circumference (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	6.22 ± 0.23^{ab}	5.87 ± 0.26^{bcd}	5.43 ± 0.28^{d}	5.61 ± 0.10^{bcd}	5.78±0.12
Phase-II	6.62 ± 0.19^{a}	5.56 ± 0.15^{bcd}	5.23 ± 0.17^{d}	5.47 ± 0.19^{cd}	5.72±0.12
Phase-III	6.18 ± 0.34^{abc}	5.47 ± 0.25^{cd}	5.46 ± 0.24^{cd}	5.59 ± 0.17^{bcd}	5.67±0.13
Means	6.34 ± 0.15^{A}	$5.63 \pm 0.135.37^{B}$	5.37 ± 0.13^{B}	5.56 ± 0.09^{B}	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.2. Slaughter Parameters

3.2.1. Live body weight (g)

Non-significant differences were observed among four close bred stock and three phases in live body weight. In CBS, M showed the highest value in terms of live body weight (g) whereas lowest value was also observed in CBS, K. In phases, the highest value was observed in the bird having phase-III. These results are in accordance with (Moran and Bilgili, 1990; Acar et al., 1991; Ahmad et al., 2013) who also reported no effect of dietary lysine on live body weight.

Table 8
Effect of dietary lysine levels on live body weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	289.00±14.26	287.22±11.52	300.56±6.335	284.22±13.07	290.25±5.69
Phase-II	300.11±14.10	299.11±16.00	308.11±10.26	309.44±16.67	304.19±6.96
Phase-III	305.33±12.92	279.22±11.30	284.44±11.42	274.67±12.90	285.92±6.14
Means	298.15±7.76	288.52±7.45	297.70±5.66	289.44±8.45	

3.2.2. Carcass weight (g)

In the present experiment significant differences were observed in carcass weight (g) among four CBS and three phases. In phases maximum value was observed in the birds having phase-III. However, no significant effect of dietary lysine on carcass weight was also observed among different CBS. In overall interaction, highest value for carcass weight was observed in CBS, S in phase-II. Similarly, significant effect of dietary lysine levels on carcass weight was also observed in Japanese quail (Hajkhodadadi et al., 2013). However, (Ahmad et al., 2013) found no significant effect of dietary lysine on carcass percentage in Japanese quail.

Table 9
Effect of dietary lysine levels on carcass weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	162.09 ± 8.3^{ab}	158.40 ± 5.65^{ab}	166.56 ± 5.49^{ab}	161.54 ± 6.11^{ab}	162.15 ± 3.14^{AB}
Phase-II	169.83 ± 7.10^{ab}	162.36 ± 8.26^{ab}	171.36 ± 4.63^{a}	168.99 ± 7.35^{ab}	168.13 ± 3.38^{A}
Phase-III	169.03 ± 6.08^{ab}	152.03 ± 5.28^{ab}	162.76 ± 7.16^{ab}	148.50 ± 6.72^{b}	158.08 ± 3.34^{C}
Means	166.98±4.06	157.60±3.72	166.89±3.32	159.68±4.09	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.2.3. Heart weight (g)

Non-significant differences were observed in heart weight (g) in different close bred stocks and three phases. However, in overall interaction there was significant effect of lysine on heart weight among four close bred stocks and three phases. Maximum value for heart weight was observed in CBS, M in phase-III while lowest value was observed in CBS, K in phase-I. These results are nor in contrast with (Ahmad et al., 2013) who found no significant effect of dietary lysine heat weight percent in Japanese quails.

Table 10
Effect of dietary lysine levels on heart weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	2.24±0.11^{abc}	2.13±0.12^{c}	2.59±0.11^{ab}	2.36±0.10^{abc}	2.33±0.06
Phase-II	2.42±0.20^{abc}	2.37±0.15^{abc}	2.38±0.12^{abc}	2.51±0.14^{abc}	2.42±0.08
Phase-III	2.63±0.16^{a}	2.44±0.13^{abc}	2.19±0.13^{abc}	2.16±0.12^{bc}	2.35±0.07
Means	2.43±0.09	2.31±0.08	2.38±0.07	2.34±0.07	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.2.4. Liver weight (g)

In the present study non-significant differences were observed in liver weight among four close bred stocks. In CBS, maximum value for liver weight (g) was observed in CBS, Z while the lowest value was observed in CBS, K. Similarly, (Ahmad et al., 2013; Hajkhodadadi et al., 2013) also reported no significant effect of different regimes of dietary lysine on liver weight in Japanese quails.

Table 11
Effect of dietary lysine levels on liver weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	7.83±1.34	6.06±0.84	6.78±0.77	7.11±0.89	6.94±0.48
Phase-II	7.90±1.06	6.59±0.84	7.32±0.97	6.90±0.45	7.48±0.47
Phase-III	6.69±1.04	5.92±0.67	7.50±1.03	7.34±0.78	6.86±0.44
Means	7.47±0.65	6.19±0.44	7.20±0.52	7.52±0.50	

3.2.5. Gizzard weight (g)

Significantly higher gizzard weight was observed in CBS, Z in phase-II, in CBS highest value for gizzard weight was observed in CBS, Z and the lowest value was found in CBS, K. These results are in line with (Ahmad et al., 2013) who also found significant effect of dietary lysine on gizzard weight of Japanese quail.

Table 12
Effect of dietary lysine levels on gizzard weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	5.57±0.36^{b}	5.84±0.30^{ab}	5.68±0.40^{b}	5.70±0.39^{b}	5.70±0.17
Phase-II	5.65±0.38^{b}	5.30±0.30^{b}	5.85±0.36^{ab}	6.90±0.45^{a}	5.93±0.21
Phase-III	6.16±0.39^{ab}	5.53±0.30^{b}	5.60±0.46^{b}	6.56±0.39^{ab}	5.96±0.20
Means	5.79±0.22^{AB}	5.56±0.17^{B}	5.71±0.23^{B}	6.39±0.25^{A}	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.2.6. Intestinal length (cm)

In the present scenario, significant differences were observed in intestinal length among different CBS and phases. Maximum value for the intestinal length was observed in CBS, M in phase-III whereas the lowest value was observed in CBS, S in phase-II. In CBS, M showed the highest value in terms of intestinal length while the lowest value was observed in CBS, S. Similarly, significant effect of lysine on intestinal length was also observed in Japanese quail (Ahmad et al., 2013).

Table 13
Effect of dietary lysine levels on intestinal length (cm) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	71.22±4.41^{ab}	74.22±2.87^{ab}	70.78±2.43^{ab}	69.11±2.65^{ab}	71.33±1.55
Phase-II	72.00±3.49^{ab}	70.33±1.80^{ab}	68.67±2.43^{ab}	71.44±3.28^{ab}	70.61±1.37
Phase-III	74.89±4.75^{a}	74.22±3.23^{ab}	64.00±2.67^{b}	64.22±2.39^{b}	69.33±1.84
Means	72.70±2.38	72.93±1.54	67.81±1.50	68.26±1.66	

Means within columns with different superscripts are significantly (P<0.05) different from other

3.2.7. Intestinal weight (g)

Non-significant differences were observed in intestinal weight among four close bred stocks and three phase. In CBS, M showed the highest value for intestinal weight (g) whereas CBS, S showed the lowest value. Similar findings was also observed by (Ahmad et al., 2013; Hajkhodadadi et al., 2013) who reported no significant effect of dietary lysine on intestinal weight in Japanese quails.

Table 14
Effect of dietary lysine levels on intestinal weight (g) in four close bred stock of Japanese quail.

	Major	Kaleem	Sadat	Zahid	Means
Phase-I	13.37±1.51	11.93±1.41	11.09±1.07	11.93±1.34	12.08±0.66
Phase-II	10.98±1.11	10.75±1.13	10.52±0.77	13.80±1.65	11.51±0.62
Phase-III	14.23±1.85	12.02±1.54	10.60±1.45	11.01±0.83	11.96±0.74
Means	12.86±0.88	11.56±0.77	10.74±0.63	12.25±0.77	

4. Conclusion

Japanese quail due to its early sexual maturity, good egg and meat production and easy maintenance make it a complete research model. In Pakistan, due to its increasing demand as a meat type bird it is necessary to maintain its nutritional composition especially Lysine level to combat its faster growth as the lysine being the second limiting amino acid used in ideal balance ration.

Acknowledgement

Author is extremely thankful to the administration at ART Centre and Punjab Agricultural Research Board (PARB) for providing financial support for the said project.

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