Full Length Article

PRODUCTION PERFORMANCE OF TANUVAS NAMAKKAL GOLD JAPANESE QUAIL FED DIET WITH DIFFERENT LEVELS OF ENERGY AND LYSINE

K. Shibi Thomas*[1], R.Amutha [2], M. R. Purushothaman[3], P. N. Richard Jagatheesan[4] and S. Ezhil Valavan[5]

Department of Poultry Science
Veterinary College and Research Institute
Tamil Nadu Veterinary and Animal Sciences University
Namakkal, Tamil Nadu, India

ABSTRACT

A biological trial was conducted with "TANUVAS Namakkal gold Japanese quail" to determine the optimum level of energy and lysine requirement on the production performance during the chick and grower phase. Seven hundred and twenty, straight-run, day-old chicks were randomly grouped in nine treatments with four replicates of twenty chicks each. Three levels of energy (2800, 2900 and 3000 kcal/kg) and three levels of lysine (1.2, 1.3 and 1.4%) were used in a 3 x 3 factorial design. Low energy (2800 kcal/kg) had significant (P<0.01) influence on the body weight, body weight gain, feed consumption and feed conversion ratio in the chick and grower phase. High (1.4%) lysine had significant(P<0.01) influence on the body weight, body weight gain in the chick phase.Low and medium lysine (1.2 and 1.3%) groups had significantly (P<0.05) better weight gain and feed conversion ratio. Low and high (1.2 and 1.4%) lysine levels recorded significantly (P<0.01) higher feed consumption during the grower phase.

Keywords: Chick and grower phase, Energy, Lysine, Production performance

Received : 08.02.2022 Revised :10.05.2022 Accepted : 11.05.2022

INTRODUCTION

A new egg type Japanese quail strain "TANUVAS Namakkal gold Japanese quail" having normal range quail plumage was evolved based on 5-way crossing technique (L32145) by the Department of Poultry Science, Veterinary College and Research Institute, Namakkal under Tamil Nadu Veterinary and Animal Sciences University. Since the production performance of these

Corresponding author; email:shibisaran@gmail.com

[1*] Associate professor and Head, Livestock Farm Complex, Veterinary College and Research Institute, Orathanadu, TANUVAS, Thanjavur, Tamil Nadu, India

[2] Professor, Professor and Head, Livestock Farm Complex, Veterinary College and Research Institute, Namakkal, Tamil Nadu.

[3] Professor and Head (Retd,), Department of Animal Nutrition

[4] Dean, Veterinary College and Research Institute, TANUVAS, Theni, Tamil Nadu, India

5 Professor, Poultry Research Station, Madhavaran Milk Colony, Chennai, Tamil Nadu, India

birds is superior, there is a need of updating optimal nutritional requirements of genetically improved Japanese quails to maximize the production potentiality.

Energy is needed for maintenance, optimum growth, egg production and reproduction and its requirement depends on the age of birds, reproductive status and ambient temperature (Shim and Vohra, 1984). Energy protein ratio and the ratio of energy to other nutrients are important in the formulation of the diet. The ideal protein concept implies feeding the best ratios between lysine and other amino acids, thus reducing the crude protein content of the diet.

This concept can be defined theoretically, as the exact balance of the amino acids in the diet capable of meeting, without excess or deficiency for production and maintenance of birds, expressing them as percentage in relation to the lysine which is adopted as reference amino acid. The ideal protein concept implies feeding the best ratios between lysine and other amino acids, thus reducing the crude protein content of the diet.Lysine in lower or excess levels may bring metabolic damages, which affects the bird's performance (Kidd and Kerr, 1998). Hence, the present study has been carried out to evaluate the effect of different dietary metabolizable energy and lysine levels, in TANUVAS Namakkal gold Japanese quail during the chick cum grower phase of the study.

MATERIALS AND METHODS

Seven hundred and twenty day old quail chicks were weighed and randomly assigned into nine treatment groups with four replicates of twenty chicks each. Nine experimental diets were formulated in 3x3 factorial arrangements with three levels of dietary energy (2800, 2900 and 3000 Kcal/kg) and three levels of lysine (1.2, 1.3 and 1.4 per cent) during chick phase (0-2 weeks) and grower phase (3-5 weeks). The ratio of methionine, methionine + cystinine, threonine and arginine to lysine were 0.43, 0.68, 0.60 and 1.07, respectively for chick phase; 0.46, 0.73, 0.62 and 1.08, respectively for grower phase. Diets were formulated to meet the requirement of amino acid but the protein level was not taken into consideration.

Birds were reared under standard and uniform managemental conditions in chickand grower cages.The quail chicks were fed with weighed quantity of experimental diets and they had free access to wholesome water. Data on individual bird weight and total feed consumption in each replicate were recorded every week.From the above data, weekly body weight gain and feed conversion ratio were calculated. 3 x 3 factorial design was used and the data were analysed statistically as per the methods described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Body weight, body weight gain, feed consumption and feed efficiency of energy x lysine interaction of data and the analysis of energy and lysine levels of the data for chick and grower phase are presented in Tables 1, 2, 3 and 4.

The energy x lysine interaction of data revealed that mean body weight (g) and body

Table 1. Ingredients and nutrient composition (%) of experimental Japanese quail chick mash (on dry matter basis)

Ingredient	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Maize	52.10	57.70	63.30	50.00	55.60	61.10	48.40	53.50	59.30
De oiled rice bran	21.30	13.50	5.70	18.30	10.50	2.70	14.40	7.60	0.00
Sunflower oil cake	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Soya	16.60	18.80	21.10	21.80	24.00	26.30	27.30	29.00	30.80
Oil	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Calcite	1.70	1.70	1.60	1.70	1.60	1.60	1.60	1.60	1.60
Di calcium phosphate	1.30	1.30	1.40	1.30	1.30	1.30	1.30	1.30	1.30
Salt	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Methionine	0.23	0.23	0.23	0.26	0.26	0.26	0.28	0.29	0.29
Lysine	0.62	0.60	0.59	0.63	0.61	0.59	0.63	0.62	0.61
Threonine	0.07	0.06	0.04	0.06	0.04	0.03	0.04	0.03	0.02
Arginine	0.17	0.18	0.18	0.16	0.16	0.16	0.14	0.15	0.16
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Nutrient composition*									
Crude Protein (%)	16.90	17.16	17.42	18.55	18.80	19.06	20.21	20.37	20.50
ME (kcal/Kg)	2800	2900	3000	2800	2900	3000	2800	2900	3000
Crude Fibre (%)	6.48	5.53	4.60	6.20	5.30	4.35	5.90	5.10	4.10
Lysine (%)	1.20	1.20	1.20	1.30	1.30	1.30	1.40	1.40	1.40
Methionine (%)	0.52	0.52	0.52	0.57	0.57	0.57	0.61	0.61	0.61
Methionine + Cystine (%)	0.82	0.82	0.82	0.89	0.89	0.89	0.95	0.95	0.95
Threonine (%)	0.73	0.73	0.73	0.79	0.79	0.79	0.85	0.85	0.85
Arginine (%)	1.29	1.29	1.29	1.40	1.40	1.40	1.51	1.51	1.51
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Available Phosphorus (%)	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Cost / kg	23.43	23.85	24.28	23.85	24.28	24.70	24.29	24.76	25.32
ME : CP	166	169	172	151	154	157	139	142	146
ME : Lysine	2333	2417	2500	2154	2231	2308	2000	2071	2143

*** Calculated values**

Table 2. Ingredients and nutrient composition (%) of experimental Japanese quail grower mash (on dry matter basis) for the first trial

Ingredient	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Maize	49.60	55.60	61.50	48.50	53.80	59.80	48.30	54.00	59.20
De oiled rice bran	18.10	10.80	3.40	14.90	8.30	1.00	14.10	6.70	0.00
Sunflower oil cake	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Soya	22.70	24.00	25.40	26.90	28.20	29.50	27.60	29.30	30.80
Oil	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Calcite	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.60	1.60
Di calcium phosphate	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Salt	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Methionine	0.25	0.25	0.26	0.29	0.30	0.31	0.36	0.37	0.37
Lysine	0.47	0.48	0.49	0.51	0.51	0.52	0.62	0.62	0.62
Threonine	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.05	0.04
Arginine	0.03	0.05	0.08	0.03	0.05	0.08	0.13	0.14	0.16
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Nutrient composition*									
Crude Protein (%)	18.70	18.69	18.69	20.01	20.03	20.03	20.34	20.47	20.54
ME (kcal/Kg)	2800	2900	3000	2800	2900	3000	2800	2900	3000
Crude Fibre (%)	6.25	5.34	4.42	5.96	5.14	4.23	5.90	5.00	4.13
Lysine (%)	1.20	1.20	1.20	1.30	1.30	1.30	1.40	1.40	1.40
Methionine (%)	0.56	0.56	0.56	0.62	0.62	0.63	0.69	0.69	0.69
Methionine + Cystine (%)	0.88	0.88	0.88	0.96	0.96	0.96	1.03	1.03	1.03
Threonine (%)	1.30	1.30	1.30	1.40	1.40	1.40	1.51	1.51	1.51
Arginine (%)	0.76	0.76	0.76	0.82	0.82	0.82	0.87	0.87	0.87
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Available Phosphorus (%)	0.36	0.35	0.35	0.36	0.35	0.35	0.36	0.36	0.35
Cost / kg	21.77	22.48	23.22	22.54	23.16	23.89	20.34	20.47	25.6
ME : CP	150	155	161	140	145	150	138	142	146
ME : Lysine	2333	2417	2500	2154	2231	2308	2000	2071	2143

*** Calculated values**

Table 3. Production performance of "TANUVAS Namakkal Gold Japanese Quail chicks" from 0 to 2 weeks of age under caged system of housing (n=4)

Treatment groups	Body weight	Body weight gain	Feed consumption	Feed Conversion Ratio
General Linear Model (GLM) analysis of Energy X Lysine level interaction				
T_1	45.99^{AB}±0.98	37.40^{AB}±0.99	73.07±1.64	1.955±0.051
T_2	42.29^{CD}±0.66	33.68^{CD}±0.67	70.94±0.48	2.113±0.065
T_3	40.29^{E}±0.63	31.72^{D}±0.63	66.13±1.38	2.094±0.092
T_4	44.00^{BC}±0.37	35.47^{BC}±0.30	69.89±1.27	1.971±0.048
T_5	44.19^{BC}±0.91	35.71^{BC}±0.92	69.96±1.70	1.961±0.048
T_6	42.32^{CD}±0.96	33.75^{CD}±0.96	69.29±1.48	2.057±0.065
T_7	48.59^{A}±0.41	40.08^{A}±0.33	71.96±0.67	1.795±0.018
T_8	45.98^{AB}±0.42	37.43^{AB}±0.34	73.15±0.99	1.955±0.025
T_9	41.73^{CD}±1.03	33.21^{CD}±1.02	69.04±1.63	2.086±0.068
P value	0.004	0.003	0.171	0.270
General linear model (GLM) analysis of Energy levels				
2800	46.19^{A}±0.39	37.65^{A}±0.38	71.64^{A}±0.77	1.907^{A}±0.032
2900	44.15^{B}±0.41	35.60^{B}±0.41	71.35^{A}±0.73	2.010^{B}±0.034
3000	41.45^{C}±0.51	32.89^{C}±0.51	68.16^{B}±0.90	2.079^{B}±0.040
P value	<0.001	<0.001	0.005	0.004
General linear model (GLM) analysis of Lysine levels				
1.2	42.86^{B}±0.47	34.27^{B}±0.47	70.05±1.10	2.054±0.043
1.3	43.50^{B}±0.46	34.97^{B}±0.46	69.72±0.79	1.996±0.031
1.4	45.43^{A}±0.43	36.91^{A}±0.42	71.38±0.80	1.945±0.042
P value	<0.001	<0.001	0.276	0.086

$^{A-D}$, Means within a column with different superscripts differ significantly (P < 0.01)

Table 4. Production performance of “TANUVAS Namakkal Gold Japanese Quail growers” from 3 to 5 weeks of age under caged system of housing (n=4)

Treatment groups	Body weight	Body weight gain	Feed consumption	Feed Conversion Ratio
General Linear Model (GLM) analysis of Energy X Lysine level interaction				
T_1	187.52±3.79	141.54±2.88	403.96±2.26	2.857±0.064
T_2	172.87±1.86	130.58±2.08	396.43±3.10	3.042±0.078
T_3	167.68±2.09	127.39±2.17	400.24±2.83	3.147±0.083
T_4	182.07±1.52	138.07±1.15	397.52±3.70	2.880±0.029
T_5	176.99±2.36	133.17±2.40	387.57±2.62	2.920±0.088
T_6	167.50±2.14	125.19±2.33	390.37±1.47	3.119±0.031
T_7	184.89±1.53	136.30±1.13	407.73±0.82	2.992±0.007
T_8	170.17±2.89	124.19±2.91	401.22±2.47	3.243±0.127
T_9	165.66±3.09	123.93±3.22	391.52±3.68	3.169±0.102
P value	0.279	0.444	0.083	0.444
General linear model (GLM) analysis of Energy levels				
2800	184.83^{A}±1.46	138.63^{A}±1.10	403.07^{A}±1.84	2.909^{AB}±0.028
2900	173.36^{B}±1.40	129.32^{B}±1.45	395.07^{B}±2.23	3.068^{B}±0.066
3000	166.95^{C}±1.43	125.50^{C}±1.51	394.04^{B}±1.98	3.145^{B}±0.041
P value	<0.001	<0.001	<0.001	0.003
General linear model (GLM) analysis of Lysine levels				
1.2	176.02±1.66	133.16^{a}±1.44	400.21^{A}±1.71	3.015^{ab}±0.053
1.3	175.52±1.24	132.13^{a}±1.22	391.82^{B}±1.91	2.973^{a}±0.043
1.4	173.58±1.58	128.14^{b}±1.53	400.15^{A}±2.43	3.135^{b}±0.058
P value	0.440	0.023	<0.001	0.042

^{a,b}Means within a column with different lowercase superscripts differ significantly ($P < 0.05$)
^{A,B,C}Means within a column with different uppercase superscripts differ significantly ($P < 0.01$)

weight gain (g) was significantly (P<0.01) higher in T_7, T_1 and T_8 than all other energy x lysine combinations. But no significant difference between the groups in weekly feed consumption (g) and weekly feed conversion ratio in the overall chick phase.

Low energy (2800 kcal/kg) and high lysine (1.4%) had highest weight and weight gain at P<0.01 significance, while low and medium (2800 and 2900 kcal/kg) energy levels resulted significantly (P<0.01) higher feed consumption and low energy level recorded significantly (P<0.01) better feed conversion ratio but lysine had no effect on feed consumption and feed conversion ratio in the overall chick phase.

This is in accordance to the earlier findings of Reis *et al.* (2014) and Reda *et al.* (2015) who reported significantly higher body weight and body weight gain in low energy. Muniz *et al.* (2016) and Omidiwura *et al.*(2016) reported that low energy group consumed more feed which is in concurrence to the results of this trial. In contrast to this study, Mahmood *et al.* (2014) observed that high energy group consumed more feed. Moura *et al.* (2007) and Alagawany *et al.*(2014) reported no significance in lysine levels for feed conversion ratio which is not in accordance to this study. On the contrary, Hajkhodadadi *et al.* (2013) reported better feed conversion ratio in high lysine groups.

Energy level is related to digestion and absorption, high energy in the feed increases the retention time of the feed and increases the nutrients availability in the gastrointestinal tract thereby reducing the intake of feed.

The energy x lysine interaction of data revealed no significant difference in mean body weight (g), body weight gain (g), weekly feed consumption (g) and weekly feed conversion ratio during the grower phase.

The significant (P<0.01) influence of energy suggested that low energy (2800 kcal/kg) group had highest weight, weight gain, higher feed consumption and better feed conversion ratio in the overall grower phase at (P<0.01).

Low and medium lysine (1.2 and 1.3%) groups had significantly (P<0.05) better weight gain and feed conversion ratio and no influence on body weight. Low and high (1.2 and 1.4%) lysine levels recorded significantly (P<0.01) higher feed consumptionduring the grower phase.

Attia *et al.* (2014) who reported significantly higher body weight and body weight gain in medium (1.3%) lysine groups and is in agreement with this trial, when, compared to other levels studied while no significance was observed by Moura *et al.* (2007) and Alagawany *et al.* (2014) due to lysine levels which is in contrast to this studies.

Energy is needed in adequate amounts, especially in the grower phase after 14 days of age as the body size in quail increases rapidly during this phase. So energy level regulates the feed intake which acts on the production performance and also affects the feed cost.

Jahanian and Edriss (2015), Kaur and Mandal (2015), Reda *et al.*(2015), Muniz *et al.* (2016) and Omidiwura *et al.*(2016) reported that low energy group consumed more feed which is in concurrence to the results of this trial. In contrast to this study Mahmood *et al.* (2014) observed that high (3000 kcal/kg) energy group consumed more feed.

The results of Moura *et al.* (2007) and Alagawany *et al.* (2014) reported no significant difference in feed consumption and feed conversion ratio due to lysine levels and the studies conducted by Hajkhodadadi *et al.* (2013) reported better feed conversion ratio in high lysine groups which is in contrast to this trial.

ACKNOWLEDGEMENT

The authors thank Tamil Nadu Veterinary and Animal Sciences University, Chennai for providing necessary facilities for carrying out this research project.

REFERENCES

Alagawany, M., El-Hindawy, M. M. and Attia,A. I. (2014). Impact of protein and certain amino acids levels on performance of growing Japanese quails.*Universal Journal of Applied Science,* **2**(6): 105-110.

Attia, A.A., El-Hindawy, M.M., Soliman, M. M.and Abou-Kasem,D. E. (2014). Lysine requirements of growing Japanese quails under Egyptian conditions 1-Winter season. *Zagazig Journal of Agricultural Research*, **41**(2): 285-290

Hajkhodadadi, I., Shivazad, M.,Moravvej, H. and Zare-shahneh, A. (2013). Effect of dietary lysine on performance and immunity parameters of male and female Japanese quails. *African Journal of Agricultural Research*, **8**(1): 113-118.

Jahanian, R. and Edriss,M. A. (2015). Metabolizable energy and crude protein requirements of two quail species (*Coturnix japonica* and *Coturnixy psilophorus*). *The Journal of Animal and Plant Sciences*, **25**(3): 603-611.

Kaur, S. and Mandal,A. B. (2015). The performance of Japanese quail (white breasted line) to dietary energy and amino acid levels on growth and immuno-competence. *Journal of Nutritional Food Science*, **5**: 4.

Kidd, M. T. and Kerr,B. J. (1998). Dietary arginine and lysine ratios and electrolyte balance. *Poultry Science*, **77**: 864-869.

Mahmood, M., Rahman, A., Saima, Akram, M., Pasha, T. N. and Jabbar,M. A. (2014). Effect of dietary energy levels on growth performance and feed cost analysis in Japanese quail. *Pakistan Journal of Zoology,* **46**(5): 1357-1362.

Moura, A. M. A., Soares, R. T. R. N., Fonseca, J. B., Vieira, R. A. M. and Couto,H. P. (2007). Lysine requirement for growing Japanese quails (*Coturnix japonica*). *Ciencia agrotech*, **31**(4): 1191-1196.

Muniz, J. C. L., Barreto, S. L. T.,Mencalha, R., Viana, G. S., Reis, R. S., Ribeiro, C. L. N., Hannas, M. I. and Albino,L.

F. T. (2016). Metabolizable energy levels for meat quails from 15 to 35 days of age. *Ciencia Rural*, **46**(10): 1852-1857.

Omidiwura, B. R. O., Odu, O., Agboola, A. F.,Akinbola, D. D. and Iyayi, E. A. (2016). Crude protein and energy requirements of Japanese quail (*Coturnixcoturnix japonica*) during rearing period.*Journal of World Poultry Research,* **6**(2): 99-104.

Reda, F. M., Ashour, E. A., Alagawany, M. and Abd El-Hack,M. E. (2015). Effects of dietary protein, energy and lysine intake on growth performance and carcass characteristics of growing Japanese quails. *Asian Journal of Poultry Science,* **9**(3): 155-164.

Reis, R. S., Barreto, S. L. T., Torres, R. A., Muniz, J. C. L., Mendonca, M. O., Viana, G. S., Ribeiro, C. L. N., Costa, S. L. and Santos,M. (2014). Crude protein and metabolizable energy for meat quail from 1 to 14 days of age. *Arquivo Brasileiro de MedicinaVeterinariaeZootecnia*, **66**(3): 903-910.

Shim, K. F. and Vohra, P. (1984).A review of the nutrition of Japanese quail. *World's Poultry Science Journal*, **40**: 261-274.

Snedecor, G. W. and Cochran, W. G. (1994). Statistical Methods.9th Edn, Iowa state University press, Ames, USA.Iowa – 50010.